INTERNATIONAL TAPPI CONVENTION

SEP 24 1934

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Paper Making Machinery
THE BAGLEY & SEWALL CO.
Watertown, N.Y.-U.S.A.

The Mark of Craftsmanship

PAPER MAKING MACHINERY

LEADING ECONOMISTS ARE OPTIMISTIC ABOUT IMPROVED BUSINESS CONDITIONS THIS FALL AND ARE BULLISH FOR 1935.

NOW IS THE TIME TO—

MODERNIZE MILL EQUIPMENT

THE BAGLEY AND SEWALL CO.

WATERTOWN — NEW YORK

U. S. A.

WALSEAL

THE PERFECT JOINT

as simple as

A
WALSEAL Fitting
Clearance
This SIL-FOS BRAZING ALLOY INSERT is a part of the fitting.
B
WALSEAL Fitting
Oxyacetylene Flame
AIRCOBRAZE Torch
C
The SIL-FOS BRAZING ALLOY flows over the entire clearance area, making a joint that is stronger than the pipe.
White ring of SIL-FOS appearing all around the pipe at this point is your visible evidence that the joint is made—and made right.

Slip pipe into Walseal fitting until it butts against fitting shoulder.

Apply flame to pipe near fitting and heat pipe to brazing temperature, thus melting the Sil-Fos brazing alloy.

Apply flame to band of Walseal fitting until white Walseal ring appears around pipe—your visible proof of a perfect joint.

No skill in brazing is required. Any mechanic, after a few minutes' instruction, can make a perfect joint every time. The right amount of brazing alloy is incorporated in every fitting opening. Merely assemble and heat.

The resulting joints are leak-proof and rust-resistant; are stronger than the pipe itself; are unaffected by vibration and by any temperature to which brass or copper pipe are subjected in service.

Try them on your next job. Gain their time and labor-saving advantages plus the assurance of a perfect joint. Bear in mind that Walseal are the only threadless fittings available for iron pipe size or extra-heavy brass pipe, although they can be used for I.P.S.O.D. thin wall copper tubing. They are available in sizes ¼" to 8" Fittings; Flanges 1½" to 12".

Write for descriptive literature.

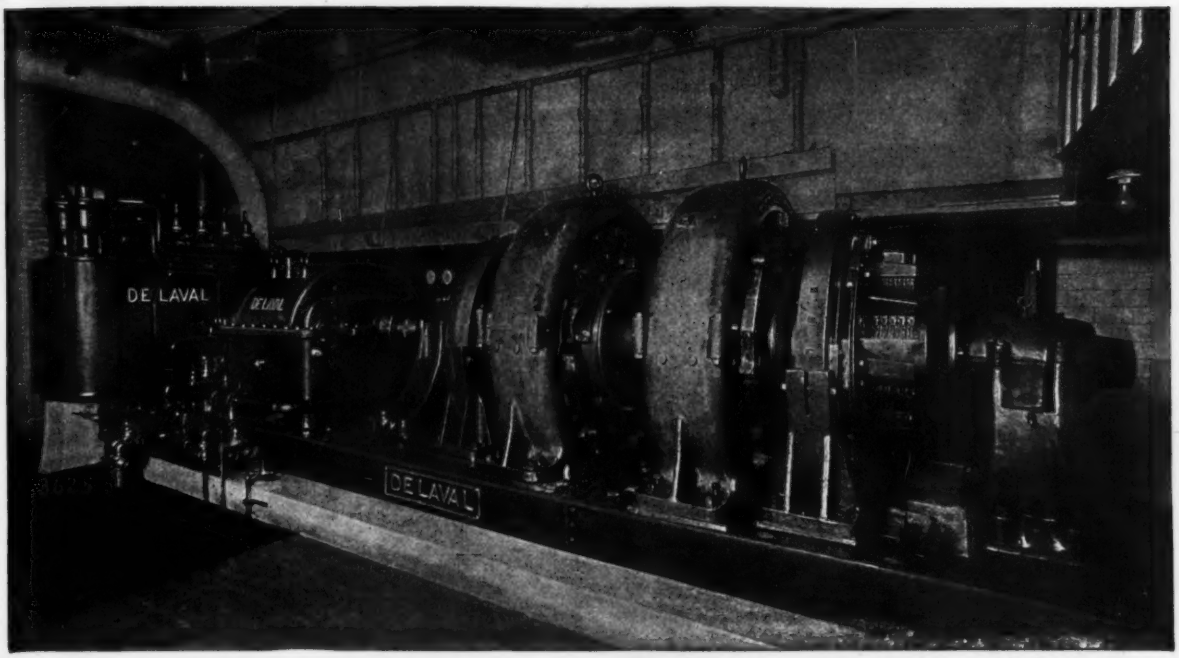
WALWORTH

VALVES FITTINGS and TOOLS
Backed by 91 Years' Service

WALWORTH COMPANY
60 EAST 42nd STREET, NEW YORK

DISTRIBUTORS IN PRINCIPAL CITIES THROUGHOUT THE WORLD

Entered as second-class matter at the Post Office at East Stroudsburg, Pa., under the Act of Congress of March 3, 1879. Published every Thursday by the Lockwood Trade Journal Co., at 34 N. Crystal St., East Stroudsburg, Pa. Executive and Editorial Offices: 15 W. 47th St., New York, N. Y.



Your Old Steam Plant Is Wasting Money

IN studying this subject you should take into account recent developments, such as higher steam pressures and temperatures, improved boilers and more efficient extraction and condensing turbines.

The 1,000 KW. De Laval extraction turbine shown in the photograph, in connection with higher pressure boilers and stokers, reduced the daily coal consumption, as compared with the Corliss engine plant which it replaced, from 28,150 lb. to 17,339 lb., in spite of an increase of 25 per cent in power load and 15 per cent in process steam load.

The change also makes room for a further increase in capacity in a previously crowded engine room.

All particulars in Leaflet O-1932.

DE LAVAL STEAM TURBINE CO.
TRENTON, N. J.

Manufacturers of Steam Turbines, Centrifugal Pumps, Propeller Pumps, Rotary Displacement Pumps, Centrifugal Blowers and Compressors, Helical Speed Reducing Gears, Worm Gears, Hydraulic Turbines, Flexible Couplings and Special Centrifugal Machinery—Sole Licensee of the Bauer-Wach Exhaust Turbine System. 3147

NOW . . . Belts Your Machine IN

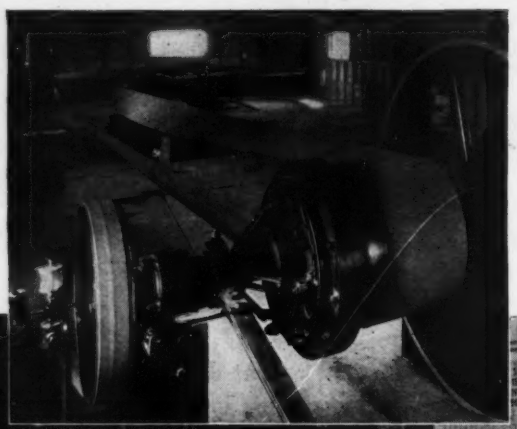
EVERY plant engineer recognizes the superiority of endless belts. But they have required dismantling of the drive, or have taken 2 to 3 weeks to get from the factory.

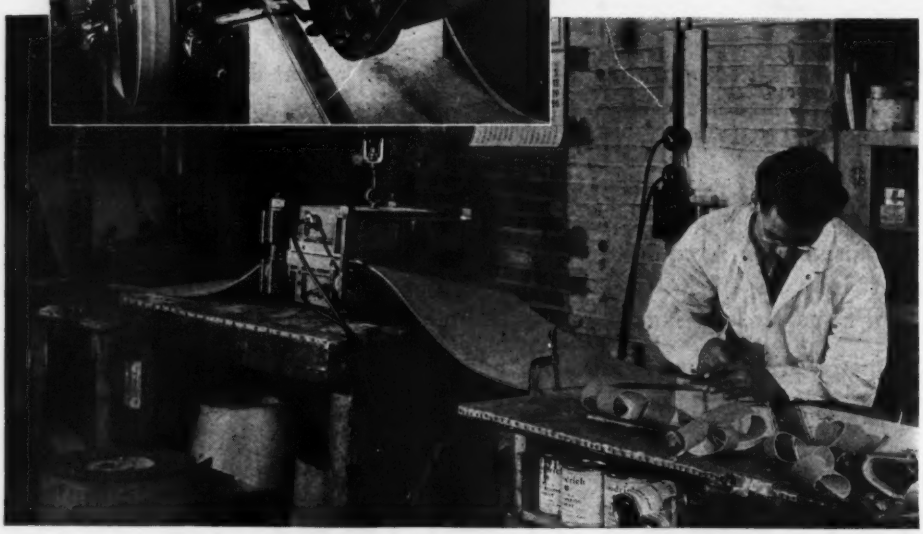
No longer.

Goodrich announces the Plylock Splice* for Highflex rubber belts, for use with a new portable vulcanizer in your plant. This Plylock Splice makes a better joint than any leather or rubber splice ever before made in the field or in the factory. It will increase the life of most belts 2 to 3 times.

Most belt trouble comes from the fasteners. At one stroke you can cut out all such trouble, simply by employing this new Goodrich Plylock method. You reduce danger of injury to your men, you reduce idle machine time, you reduce belt maintenance time and cost . . . and you increase belt life, belt service, plant production, net profit.

Belt ends can be prepared in advance, and the Plylock Splice can then be vulcanized by any mechanic, on your





TOP LEFT

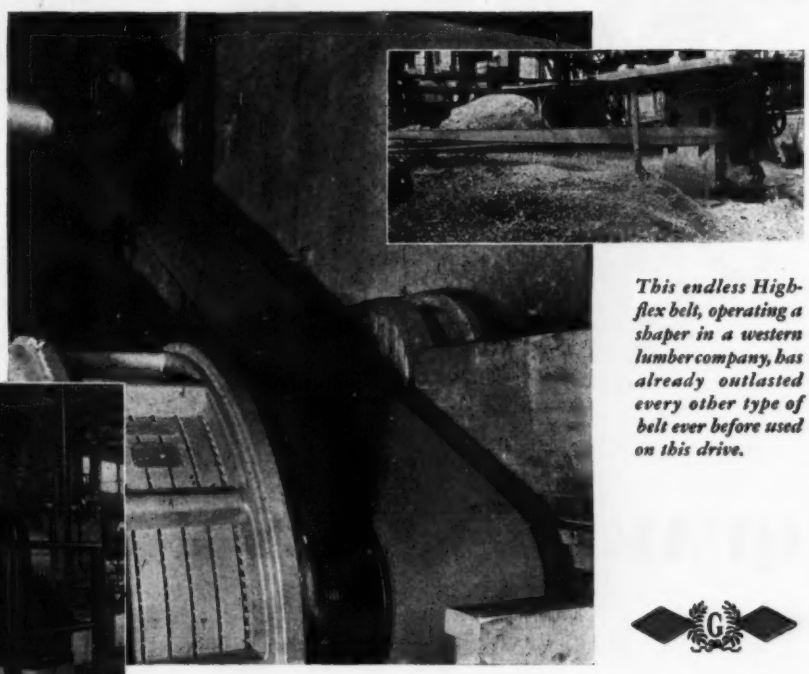
An endless Highflex Belt in the oil fields, driving a band-wheel power.

Cutting the Plylock Splice, preparatory to making a Highflex Belt endless on the machine. Any good mechanic can learn the complete operation in a few hours.

Goodrich

Made Endless on A FEW HOURS

On paper mill drives, Highflex again demonstrates its value as a money-saver. Here is the belt which does not cause costly shutdowns. Can be made endless on the machine, and costs less every time.



Gas compressor in California, driven by endless Highflex.

This endless Highflex belt, operating a shaper in a western lumber company, has already outlasted every other type of belt ever before used on this drive.

machine in a few hours—and then used immediately. Small belts, 3 or 4 inches wide, need less time, frequently less than an hour.

Vulcanizers for this Plylock method cost from $45, depending on the size of belt you use, and in most plants pay for themselves in a few months. Or, most Goodrich Distributors are equipped to do the work for you, in their shop or on your machine.

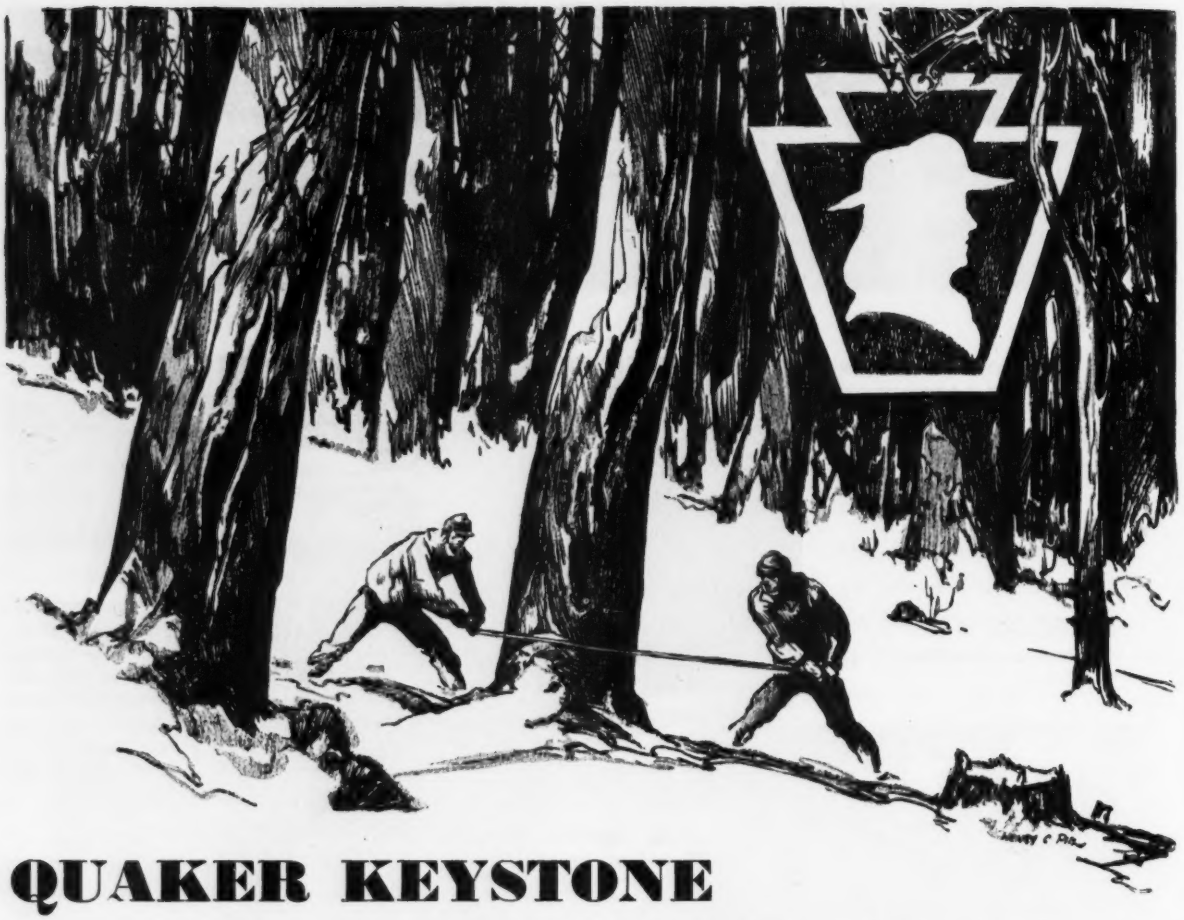
Test cases of Plylock endless belts have been running for two years, on all types of drive. They prove conclusively that this revolutionary method doubles the life of many belts and invariably cuts belt cost drastically. Let your Goodrich Distributor show you what it can do in your plant. The B. F. Goodrich Company, Mechanical Rubber Goods Division, Akron, Ohio.

* Patent applied for

ALL *products problems* IN RUBBER

Highflex Belting

We're so proud of Highflex that we give it a permanent brand—the *red edge*—the mark of the belt with the 14 new improvements.



QUAKER KEYSTONE CHLORINE

The dependable quality of this product is the result of more than eighty-three years' experience in making chemicals for industry.

Furthermore, due to the convenient location of our plants, quick deliveries of Chlorine can be made to all parts of the country.

We will be glad to furnish highly specialized technical advice, upon request, without cost.

CHEMICALS
for the
PAPER INDUSTRY

CHLORINE CAUSTIC SODA
SODIUM ALUMINATE
PENCHLOR
(High-Test Calcium Hypochlorite)
PENCHLOR ACID-PROOF CEMENT
ALUM
ANHYDROUS AMMONIA
BLEACHING POWDER
(Standard Strength)

Est. 1850

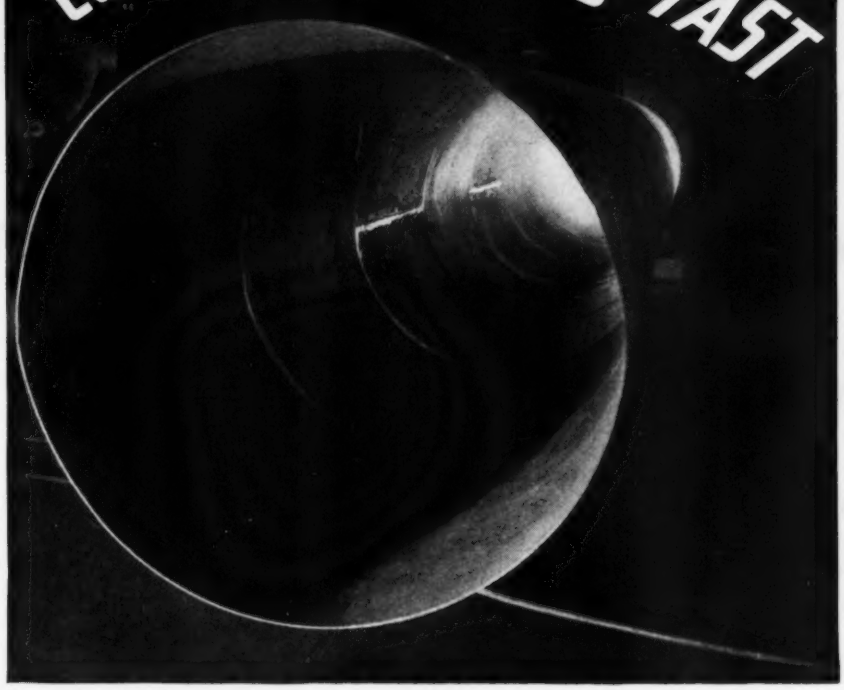
TRADE MARK

PENNSYLVANIA SALT MFG. CO.

EXECUTIVE OFFICES, WIDENER BLDG., PHILADELPHIA, PA.
Branch Sales Offices: New York--Chicago—St. Louis—Pittsburgh—Tacoma—Wyandotte

315,000 POUNDS OF PLYKROME

to keep air moving—FAST



● A section of the five-foot air duct for the Milwaukee Sewage Disposal Plant... five feet in diameter... with a total length of 1800 feet. One-quarter inch Plykrome is the material.

ONE of Plykrome's advantages is the smoothness of its stainless surface... a coefficient of friction so low as to present little resistance to the passage of air, gases or liquids under pressure. Another advantage is the resistance of its stainless steel surface to corrosion over long periods of time. A third is the facility with which it fabricates.

This combination of qualities led to the adoption of Plykrome for a giant air duct in Milwaukee's Sewage Disposal Plant. 315,000 pounds of one-quarter inch Plykrome is being fabricated into an 1800-foot pipe line ranging up to five feet in diameter.

The entire installation is being fabricated by arc welding... speedily and economically. Once installed its resistance to corrosive action will assure efficiency without maintenance or replacement.

For any installation in which corrosion resistance on one side is enough and where cost saving is a factor, it will pay you to investigate Plykrome. Full information will be sent on request.

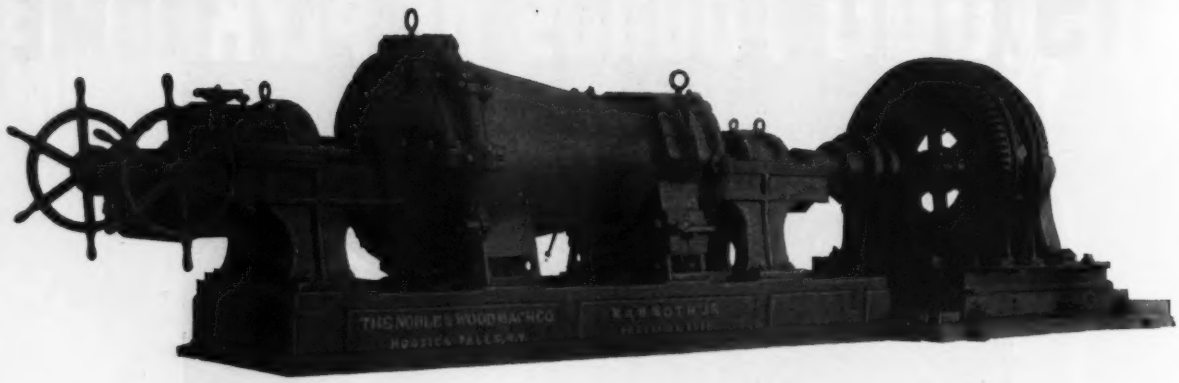
USS PLYKROME

U S S CHROMIUM-NICKEL ALLOY STEELS ARE PRODUCED UNDER LICENSES OF THE CHEMICAL FOUNDATION, INC., NEW YORK, AND FRIED. KRUPP A. G. OF GERMANY

Illinois Steel Company

208 SOUTH LA SALLE STREET • CHICAGO, ILLINOIS

SUBSIDIARY OF UNITED STATES STEEL CORPORATION



A Jordan of Battleship Sturdiness

Noble & Wood Jordans are built like a battleship, strong, sturdy. They have always had the reputation for sturdiness. Built to withstand abuse. Look at one and you'll agree that a Noble & Wood Jordan deserves that reputation.

As an indication of the ruggedness of the Noble & Wood Jordans and the attention to construction details that tend to long life, on the small end of the plug is a patented cast steel disc. This disc serves the double purpose of taking the abuse to which the small end is subject and holding the plug bars securely. Its grip is positive.

But strength isn't the Noble & Wood Jordan's only attribute. It is well designed. Does a real job.

These jordans are used in mills making every kind of paper from news and kraft to the finest bonds and book papers. The list of users looks like a "Who's Who" in the paper industry.

They are made in a range of sizes from 6 to 100 tons and up. Can be furnished with either plain or anti-friction bearings, belt driven or direct connected to motor. Plugs are made either banded or bandless type.

If your mill is one of the few where Noble & Wood Jordans are not running, write us and let us show you why Noble & Wood Jordans are BETTER.

The Noble & Wood Machine Co.

Hoosick Falls, N. Y.

PAPERINE

TUFJEL

SALES

Definite results from a unique strong flexible film.

INCREASES
MULLEN-FOLD-TENSILE

A. M. MEINCKE & SON, INC.

7 SO. DEARBORN ST.

CHICAGO, ILL.

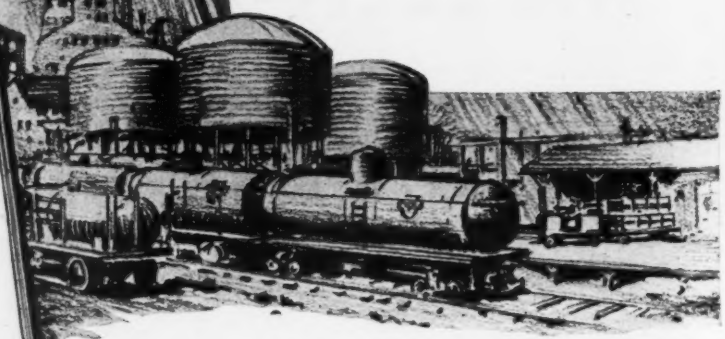
Aluminum Sulphate

(Paper Makers' Alum)

THE Company's business has been built, from the start, on a determination to serve all industry, not only well, but extraordinarily well — both in the quality and uniformity of its product, and in service to the customer. That policy will continue to govern the execution of every order.

Also other
PAPER MAKERS' CHEMICALS
of
Standard Purity
Including
Sulphuric Acid
Sodium Fluoride
Sodium Silicate
Salt Cake
Anhydrous Bisulphite Soda
etc., etc.

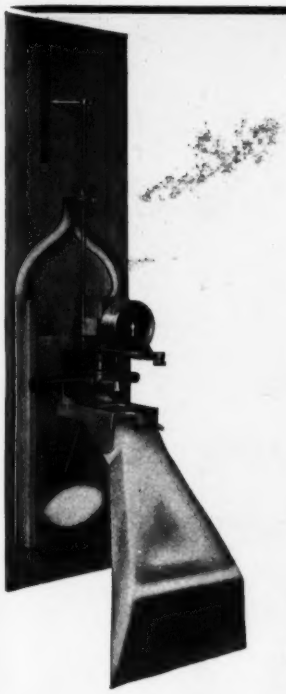
And
BAKER & ADAMSON
Chemically Pure
and
Fine Chemicals
for
Laboratory
and
Process Use



GENERAL CHEMICAL COMPANY

Home Office: 40 Rector Street, New York, N. Y.
Cable Address: LYCURGUS, N. Y.

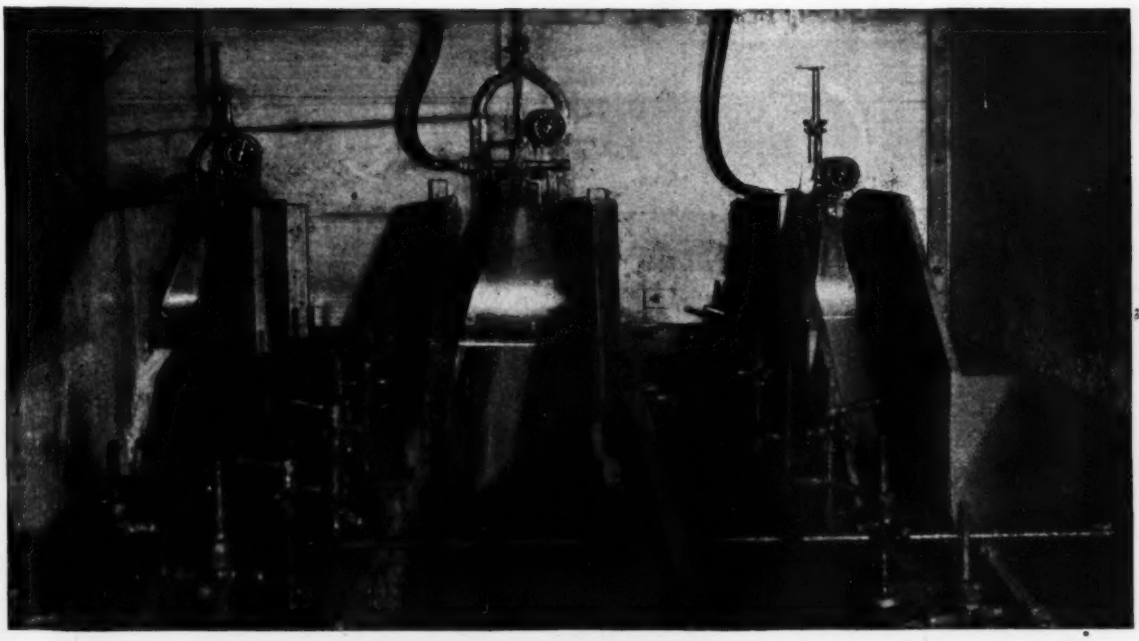
Sales Offices: Buffalo, Chicago, Cleveland, Denver, Los Angeles, Philadelphia, Pittsburgh, Providence, San Francisco, St. Louis
In Canada: The Nichols Chemical Company, Limited, Montreal, P. Q.



Poirier Weight Governor

Automatically Controls Weight and Caliper

Simple and Effective
Easy to Install



POIRIER INSTALLATION MULTI-CYLINDER BOARD MACHINE
PREVENTS OVERWEIGHT OF LINER

Write for particulars of the new Sturtevant Double Control

STURTEVANT MILL CO. HARRISON SQUARE **BOSTON, MASS., U.S.A.**

ELIXMAN

Straight wound paper cores made in sizes from 2" to 10" inside diameter with any thickness wall required.

Long draw protected slot caps of heavy gauge steel in all sizes.

Heavy duty caps with reenforced square hole. This new patented feature of reenforcement gives added strength and durability.

Samples of caps or cores will be gladly submitted.

ELIXMAN PAPER CORE COMPANY, INC.
CORINTH, N. Y.

MANHATTAN COUCH ROLLS

with Ends sealed against Corrosion

One of the serious troubles that has been experienced with Rubber Covered Couch Rolls has been the tendency of the rubber covering to loosen or become flared at the ends. This condition is caused not only by deckle wear, but also by a weakness in the adhesion primarily due to corrosion causing a rust formation building up between the end-spiders and the shell of the roll body. This formation tends to cause expansion which in many cases has resulted in the rubber covering becoming loose or flared at the ends, often times necessitating the removal of rolls from the machine. Manhattan Couch Rolls are made with "Sealed Ends" that give absolute protection against this evil and have many other characteristics that are essential for long life, durability and continuous service . . . Manhattan Couch Rolls have a covering that will give you full couching value, which is especially bonded to the metal with a thin binder material, whalebone-like in nature that actually performs a serviceable part of the covering. It adheres tenaciously to the metal and also to the soft resilient rubber covering. In addition, it acts as a cushion between the soft rubber and the hard rigid metal and definitely lessens the stress which otherwise is set up if a soft covering is applied directly to a rigid material like steel or iron. . . . The fact that a Couch Roll has a very soft rubber cover with constant flexing of the cover at the point of bond between the metal, without an intermediate binder of a flexible nature, should receive the consideration of paper mill men. . . . Write us for further details and let us tell you of the many installations we have furnished to many of the leading mills in the industry. Manhattan Rolls are made in Passaic, N. J., or Neenah, Wis., whichever is nearer to you.

Condor LINE

V-Belt
Compensated Belt
Conveyor Belt
Air Hose
Acid Hose
Water Hose
Fire Hose
Steam Hose
Suction Hose
Mill Sundries
Oilless Bearings
Industrial Brake Blocks and Lining

THE MANHATTAN RUBBER MFG. DIVISION
OF RAYBESTOS-MANHATTAN, INC.

EXECUTIVE OFFICES AND FACTORIES, PASSAIC, NEW JERSEY

One of the FASTEST Blues

Du Pont Anthraquinone Blue 3G is one of the fastest to light of the blues used for surface staining. It is very suitable for light to medium blue shades in which extreme light fastness is essential.

It is brilliant, greenish blue in shade and has excellent solubility.

If you have not tested this dyestuff, give it a trial. Sample mailed on request.

DU PONT DYESTUFFS
REG. U.S. PAT. OFF.

E. I. DU PONT DE NEMOURS & CO., INC.
Organic Chemicals Department
DYESTUFFS DIVISION . . . WILMINGTON, DELAWARE

REX CHAIN

FOR EVERY DRIVE & CONVEYOR

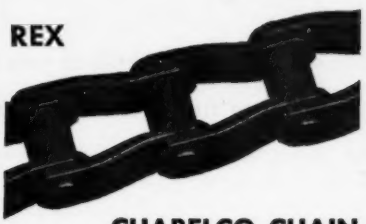
FOR EVERY PULP AND PAPER MILL USE . . .

REX

ROLLER CHAIN

The most highly finished chain on the market today for long service and low cost on high speed drives.

REX



CHABELCO CHAIN

A strong, long-wearing chain. Built with the famous Unit Link. For heavy duty drives at somewhat slower speeds—also in conveyor sizes.

REX

DUROBAR

An improved combination chain—the block link of either malleable or Rex Z-Metal—the latter the strongest, most wear-resisting metal cast in chain.

REX

GRIPLOCK

In malleable. The Griplock joint makes it a stronger chain—size for size and link for link—also cast in Z-Metal for longer, harder wear.

REX BARKING

DRUM CHAIN

An all-steel chain—especially designed for this service. Made from high grade steels to provide greater strength, greater resistance to shocks and strains, and longer life on barking drums.

OTHER REX CHAINS AND CONVEYORS

The Chain Belt Company also makes many other chains in Malleable, Z-Metal, Steel and Combination for pulp and paper mill use, as well as conveyors, including Wood Room Conveyors, Wood Yard Conveyors and Paper Conveyors.

CHAIN BELT COMPANY
1633 W. Bruce St. MILWAUKEE, WIS.

West Coast Offices

1414 Santa Fe Ave., Los Angeles, Calif.
215 S. W. 1st Ave., Portland, Oregon
909 Harrison St., San Francisco, Calif.
1212 6th Ave., South, Seattle, Wash.

CHAIN BELT COMPANY

CHAIN & BELT CONVEYING

FINE FINISH with WATERBURY FELTS

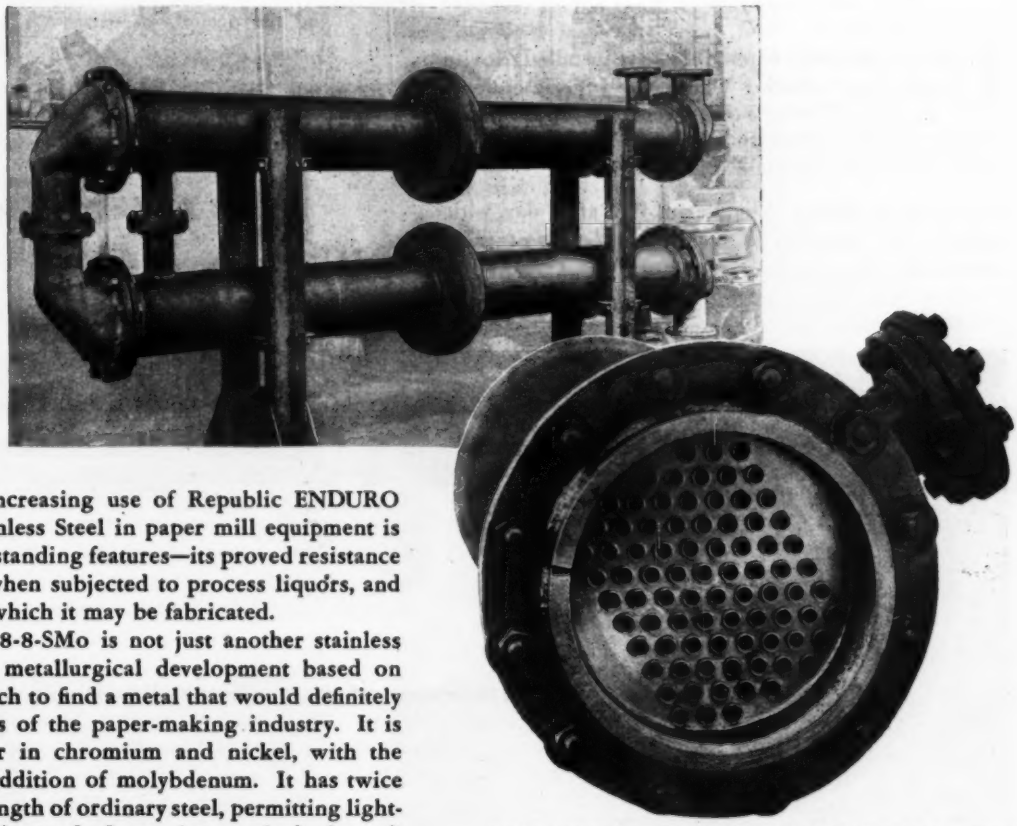
REGARDLESS of the kind of paper you make, there is a high standard of finish that you strive to maintain.

WATERBURY FELT COMPANY FELTS will help you to maintain your standard—they will deliver—and they will do it at a satisfactory speed. Felts showing our trade-mark will help you meet your production problems—because they are always dependable.

Write us about your felt problems. We will gladly help you.

The Waterbury Felt Co.
SKANEATELES FALLS, N. Y.

ELIMINATE ACID CORROSION TROUBLES WITH ENDURO



Cooking Acid Exchanger, fabricated by Electric Steel Foundry Co., Portland, Ore. Tubes and sheets are of ENDURO 18-8-SMo. *Header sheets and castings are* ESCO Alloy 45. *Tubes are electric resistance welded, furnished by Steel & Tubes, Inc., Cleveland, Ohio. Sheets were supplied by Republic Steel Corporation. Castings were made by Electric Steel Foundry Co.*

The steadily-increasing use of Republic ENDURO 18-8-SMo Stainless Steel in paper mill equipment is due to two outstanding features—its proved resistance to corrosion when subjected to process liquors, and the ease with which it may be fabricated.

ENDURO 18-8-SMo is not just another stainless steel. It is a metallurgical development based on years of research to find a metal that would definitely meet the needs of the paper-making industry. It is slightly higher in chromium and nickel, with the further alloy addition of molybdenum. It has twice the tensile strength of ordinary steel, permitting lighter sections to be used. It can be punched, sheared, drilled, machined and is easily welded. It requires no heat treatment after fabrication or welding, as there is no carbide precipitation adjacent to the weld.

In its many forms—sheets, plates, strip, electric weld tubes, bars, rods, nuts, bolts, rivets, screws and castings—it facilitates the manufacture of equipment that must withstand corrosion, such as evaporators, condensers, heat-exchangers, circulating systems, relief lines, valves, fittings, pumps, and blow pit bottoms.

Republic metallurgists will give you more complete information, on request.

CENTRAL ALLOY DIVISION . . MASSILLON, OHIO

REPUBLIC STEEL CORPORATION

GENERAL OFFICES YOUNGSTOWN, OHIO

ENDURO

REPUBLIC'S PERFECTED STAINLESS AND HEAT-RESISTING STEELS

ALLOY AND CARBON STEELS • TONCAN IRON • STAINLESS STEEL • PLATES
HOT AND COLD ROLLED STRIP • BLACK, BLUE ANNEALED AND GALVANIZED SHEETS
SPECIAL FINISH SHEETS • PIPE AND TUBULAR PRODUCTS • NUTS, BOLTS, RIVETS, ETC.
BARS AND SHAPES • TIN PLATE • WIRE PRODUCTS • DIE ROLLED PRODUCTS

Licensed under Chemical Foundation Patents Nos. 1316817 and 1339378.

EIGHTY HOUR BURRING CYCLES ARE NOT UNKNOWN

IN many of the mills where they have installed Aloxite Brand Pulp Grinding Wheels the superintendents tell us there is little or no difference in the character of the pulp just before and just after burring or sharpening the surface of these wheels.

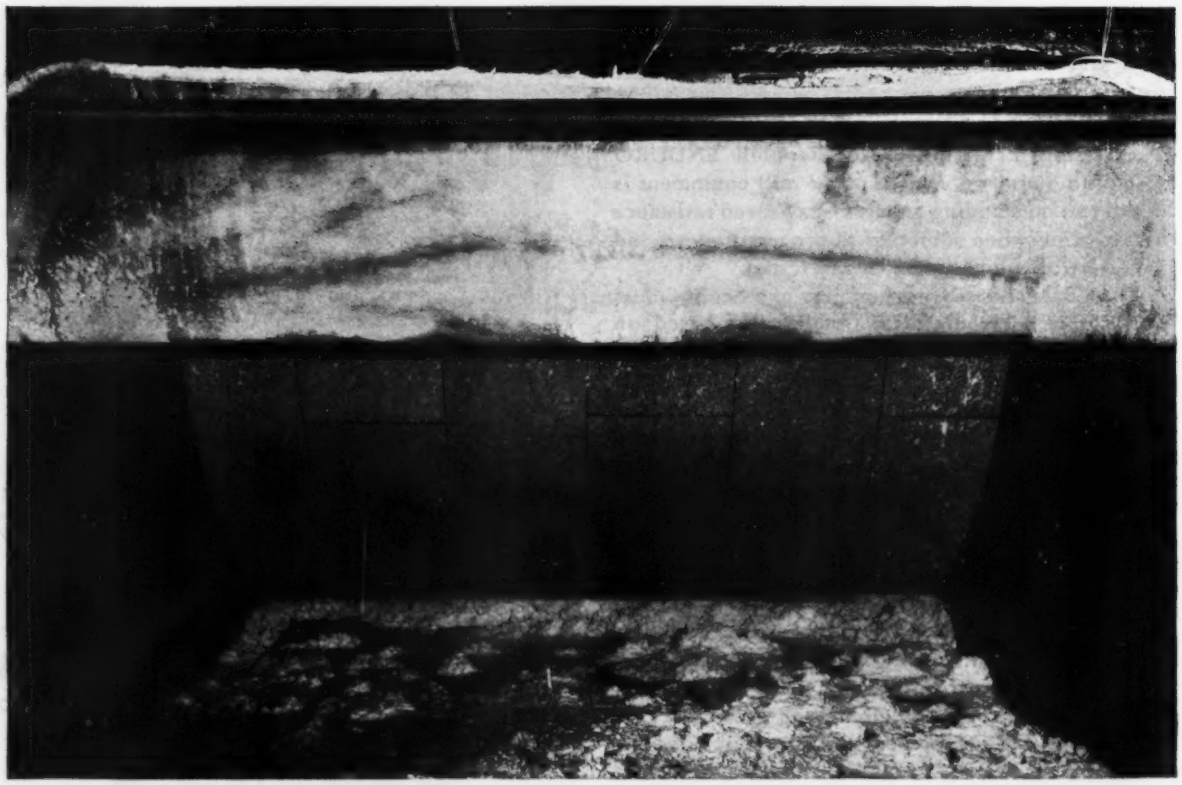
That Aloxite Brand Wheels run day after day with scarcely any variation in quality or quantity of pulp produced. This is due to two things.

1 The uniformity of structure and texture of the Aloxite Brand Wheels. There is no variation in hardness, toughness, porosity or density of the scientifically controlled building of these wheels.

2 The ability of the wheels to retain their given burr or sharpness over long intervals—eighty hour burring cycles are not uncommon. It is obvious that longer burring intervals cut to a minimum the effect of the periods of excessive sharpness, just after burring, and the periods of excessive dullness previous to burring.

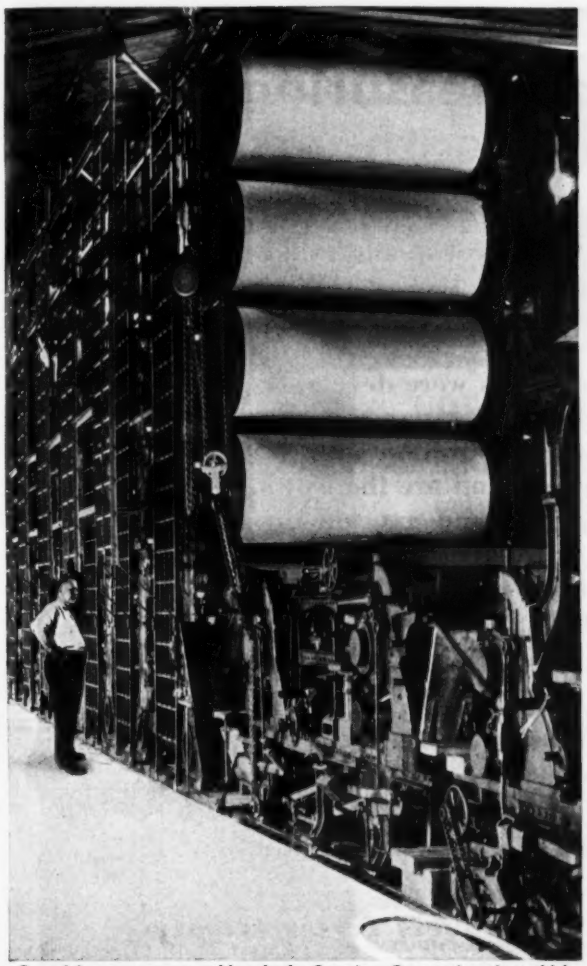
Hence the greater production of high quality pulp from Aloxite Brand Wheels which can be built to order to meet the conditions of your mill.

ALOXITE BRAND
REG. U. S. PAT. OFF.
PULP GRINDING WHEELS



THE CARBORUNDUM COMPANY
NIAGARA FALLS, N. Y.

(Carborundum and Aloxite are registered trade-marks of The Carborundum Company.)



One of the great paper machines in the Container Corporation plant which is kept in continuous trouble-free operation by Gulf quality lubrication.

CONTAINER CORP'N. KEEPS COSTS DOWN WITH GULF LUBRICANTS

THE Wabash, Indiana plant of the Container Corporation of America is another in the long list of leading paper mills which have standardized on Gulf quality lubricants and engineering service.

Leaders in the industry recognize that lubrication is the *most important single factor* in the economical operation of paper making machinery. They have found that the use of Gulf lubricants brings about five important savings in operation: decreased power consumption, lower maintenance costs, less "broke", increased production and better texture in the finished product.

Gulf lubricants can help keep costs down in your plant. We suggest that you discuss fully with a trained Gulf engineer just what can be done to improve the operation of your paper making machinery through better lubrication. He can be of material assistance to you.

GULF REFINING COMPANY, PITTSBURGH, PA.

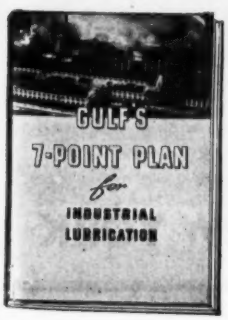
District Sales Offices:

Boston New York Philadelphia Atlanta New Orleans
Houston Pittsburgh Louisville Toledo

GULF INDUSTRIAL LUBRICATION

Exterior view of the plant of the Container Corporation of America in Wabash, Indiana.

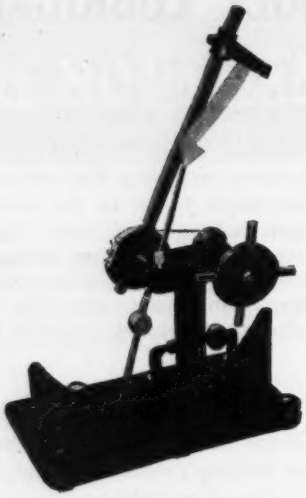
View of the power house where Gulf steam cylinder lubricants help keep power making costs down.



If you, like most paper mill operators are looking for a means to reduce maintenance, power and lubrication costs, we suggest that you familiarize yourself with the brief contents of this booklet. It will help you set up a *definite* and *practical* cost saving plan in all departments of your plant which will increase the efficiency of all mechanical operations throughout the mill.

GULF REFINING COMPANY P. T. J. 9
3800 Gulf Building, Pittsburgh, Pa.
Please send me, without obligation, the booklet "Gulf's 7-Point Plan for Industrial Lubrication."
Name.....
Title.....
Company.....
Address.....

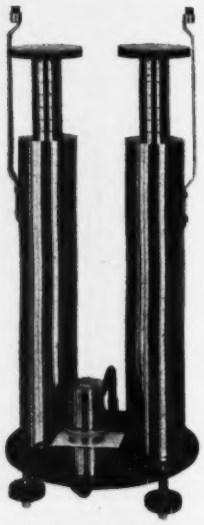
New Instruments for Measuring Paper Stiffness and Smoothness



R. D. Stiffness Tester

Paper manufacturers and technical men who want close control of quality will be interested in the new Gurley R. D. Stiffness Tester and R. D. Smoothness Tester.

These instruments were developed by one of the largest paper manufacturers in collaboration with W. & L. E. Gurley, and are the result of thorough test and experiment. They are substantially and accurately made, and they provide a simple test, of practical sensitiveness.



R. D. Smoothness Tester

R. D. Stiffness Tester (left)

An instrument for evaluating paper as to stiffness, softness, pliability, "feel", etc. Will accommodate all grades of paper in which stiffness is a factor—tissue, news, bond, hanging, postcard, kraft, bristol, tabulating, and bottle.

Simple design and construction. Readings taken with, and against, any curl, on the one sample. Results expressed in milligrams.

Improved Gurley Densometer

R. D. Smoothness Tester (right)

For evaluating the surface of paper. Measures the "finish", or the mechanical smoothness of paper by determining the rate at which air flows through the inequalities in its surface. Shows difference between "felt" and "wire" sides, detects variations in calendering, and helps control other factors which determine the character of the paper surface.

Both felt and wire sides measured at same time.

Low unit pressure applied to sample, thus causing no change in its finish.

Operation is easy and simple.

Instrument is readily portable.

Design and construction are simple.

Manipulation time is small percentage of testing time.

Duplicate instruments are standardized to practical working limits.

Improved Gurley Densometer

The standard instrument for measuring the porosity of paper. An aid in evaluating paper in terms of hydration, finish, calendering, coating and saturating effects, and absorption. Conforms to standard TAPPI method of testing.

Now improved, will accommodate wide variety of papers by varying pressure and orifice opening. Unnecessary to cut paper sample to any particular size. Now furnished with powerful capstan clamp, preventing side-leakage over the surface.

Descriptive literature sent on request.

W. & L. E. GURLEY, TROY, NEW YORK

NOW IN OPERATION
400 Camachine Mill Type Winders and over 1700 Rewinders
OVER 2000 Camachine Slitters and Rewinders in operation, with many firms operating more than 15 machines, is striking proof of the unique position held by this company in solving the slitting and roll-winding problems of the paper industry.
Because Camachine Slitters and Rewinders assure production of uniformly wound rolls, straight at the ends and free from slitter cracks at the edges, it is well worth your while to consult this company when contemplating the purchase of slitting and roll-winding equipment.
Rolls produced on Camachine Slitters and Rewinders cost less to produce and are easier to sell. Let us furnish the facts.
CAMERON MACHINE COMPANY
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Brooklyn, N.Y.

Have you written for your copy?

—every mill engineer should have this helpful bulletin

HERE is a bulletin on centrifugal pumps that you will want to keep for its helpful data and useful information. It has been prepared by the oldest American manufacturer of centrifugal pumps with 70 years of specialized experience in building pumps for paper and pulp mills. In this bulletin you will find general process charts showing centrifugal pump applications and listing authoritative Morris recommendations for each mill service; sectional and exterior views, typical performance curves and descriptions of the Morris Pump types which represent the longest experience and the latest developments in centrifugal pump practice; and considerable useful information of special interest to paper and pulp mill engineers. If you do not already have a copy of this bulletin, be sure to send the coupon today.

Every Morris Centrifugal Pump type, whether for special process or general plant service, clear water or chemicals, thin or thick stock, has been specially developed for its particular operating requirements and includes several distinctive features of design and construction which have proven to promote high efficiency and low maintenance expense. Be sure to confer with the Morris Engineers before deciding on centrifugal pumps for plant extensions or replacements. Their authoritative advice is offered without charge or obligation and may point the way to unexpected savings in equipment or power.

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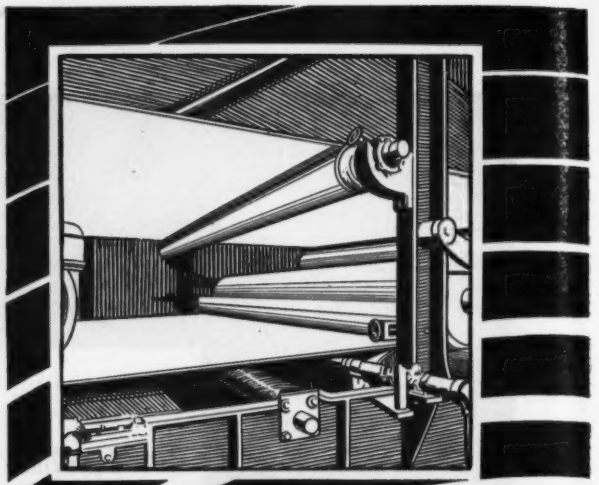

Two Kernels In this Nut

Certainly Orr weaves fine felts but so do Orr's competitors. Paper mill felts have to be good or they are no good.

Rather than emphasize quality, Orr would stress the importance of adopting the felt that will best meet the need—and there is such a felt.

Avoid the felt that is just about right. Consult your Orr representative and between the two of you, settle on the felt that is exactly right.

That is one of the kernels in the nut. The other is the precautions you take lest your felts be injured on the machine or during washups.

An Orr representative would be glad to call; or write to

THE ORR FELT AND BLANKET COMPANY
PIQUA, OHIO

ORR FELTS

WATCHING ELECTRIC EXPENSE *But* NEGLECTING SCREEN WASTE

OFFICE closing time . . . everyone guarded against leaving on lights unnecessarily, to save a few cents. Yet, in the plant, your obsolete screen keeps wasting hundreds upon hundreds of dollars in numerous repairs and adjustments causing shutdowns, costly waste of time in cleaning due to inaccessibility, not alone considering the frequent losses in sales because of the inferior paper manufactured.

You can stop these wastes with the new Jones Screen because its capacity ranges from a few hundred pounds per hour up to 6000 pounds, depending on type of stock. The open end drum allows complete accessibility as the drum itself has an efficient shower system which combined with proper vat design providing for floating and heavy dirt discharges allows the screen to operate clean and up to maximum efficiency at all times. Its drum drive and pulsating mechanism are of sturdy design and run quietly and positive, assuring continual operation with low maintenance and labor costs.

THE JONES LARGE CAPACITY SCREEN

It will pay you to learn more facts as to how this screen will help your production problem giving a cleaner and more uniform sheet at a lower production cost.

Why not let our sales engineer in your territory give you the facts? Your inquiry implies no obligation.

Jones

E. D. JONES & SONS COMPANY-PITTSFIELD, MASS.

Builders of High-Grade Machinery for Paper Mills

F.C.HUYCK & SONS

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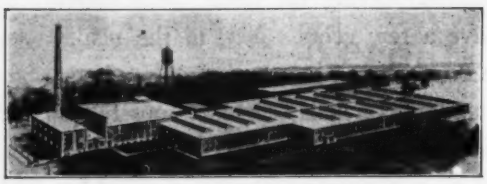
ALBANY, N.Y.

KENWOOD WOOL PRODUCTS REG. U.S. PAT. OFF.

Manufacturers of Kenwood Felts and Jackets for all Pulp and Paper Making Purposes since 1870



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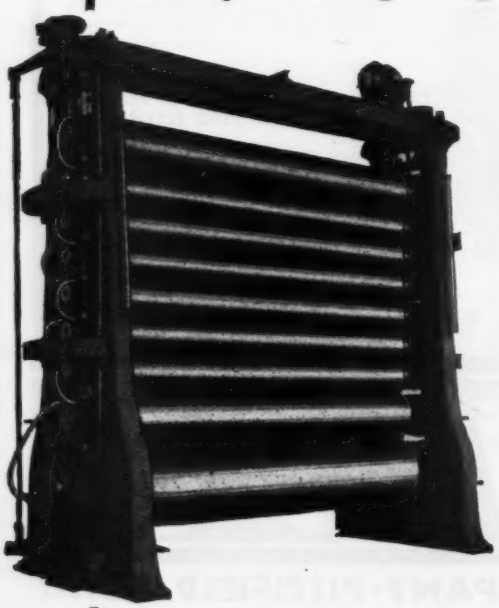
NRA

They Keep up a High Production Rate

—because they're Precision-built, Rugged and Reliable Machines



LOBDELL CALENDER STACKS

do give COMPLETE SATISFACTION, otherwise from one to ten stacks each, would not have been purchased by over 300 different paper mills.

LOBDELL STACKS are truly "precision machines," backed by over a half century's experience—and built of the finest available materials and parts by Craftsmen.

All Lobdell Stacks are equipped with "floor controlled" Lifting Device, operated by Motor, Ratchet or Hydraulic Cylinder. Other advantages are perfect and infallible lubrication and the "exclusive" Lobdell PURALOY Chilled Iron Rolls which will outwear all others and give a highly uniform finish.

Write for literature.

OTHER LOBDELL PRODUCTS:
Precision Roll Grinding Machines.
"Puraloy" Chilled Iron Calender Rolls
Improved Roll Calipers.

LOBDELL
CAR WHEEL COMPANY
98 Years in Business
WILMINGTON·DELAWARE

for Greater OPACITY

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Write us direct, or consult a nearby UNITED branch office about a trial lot.

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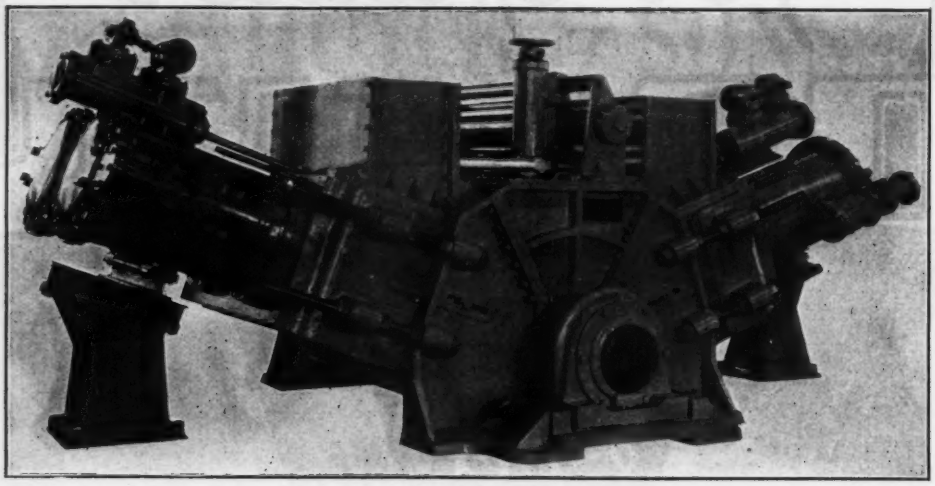
UNILITH — UNITED LITHOPONES — TITANATED TIDOLITH HIGH STRENGTH

THE GREAT NORTHERN GRINDER



Manufacturers on the Pacific Coast—as well as those in the east—will find that the Great Northern grinder can effect further production economies in mill operation. The design of the grinder is especially well adapted to the large sizes of wood in use on the west coast. Factual material regarding this grinder will be sent without obligation.

MONTAGUE MACHINE COMPANY
Turners Falls, Mass.

"NON-USERS ARE THE LOSERS"

SPEED AND ENDURANCE

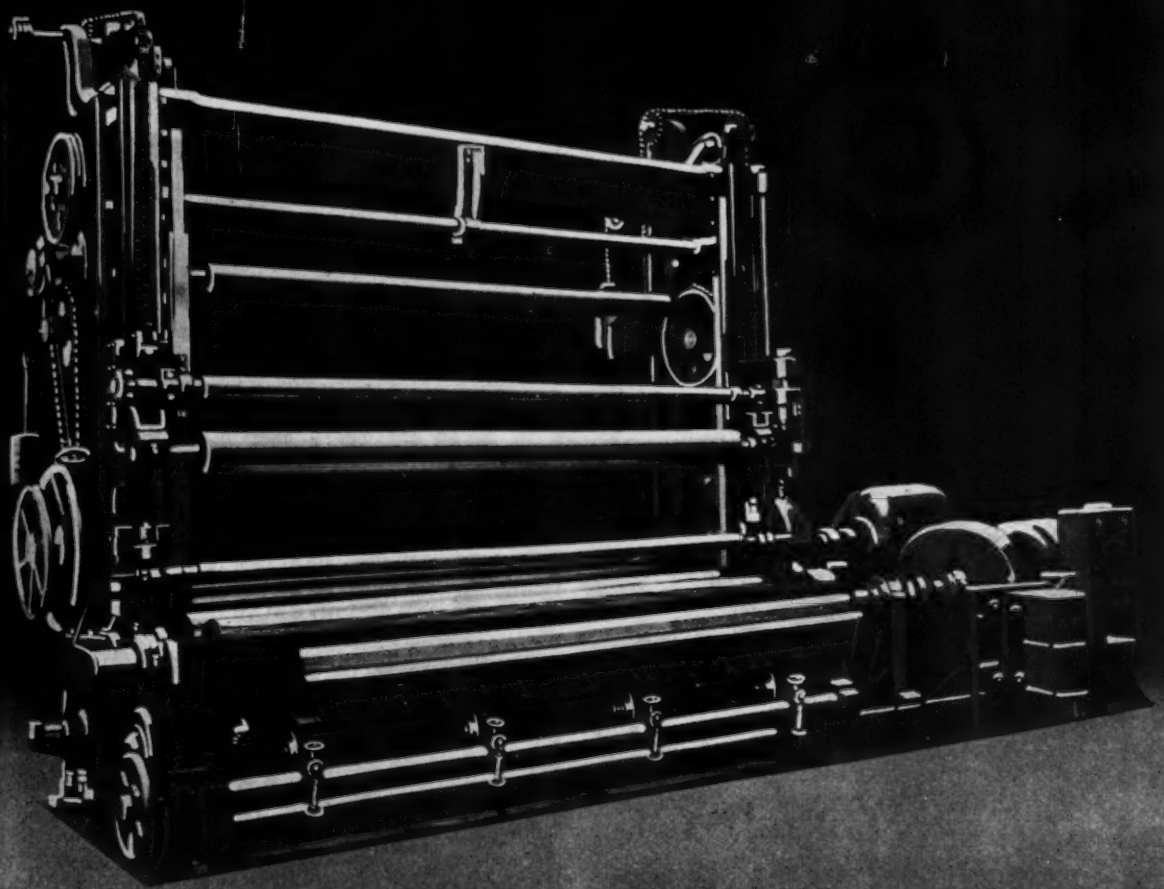
TENAX FELTS

TENAX Stands For TENACITY

Built-in Durability that makes TENAX FELTS tackle the tough jobs along with the easier finer production runs, and make good over long periods—that's T E N A C I T Y—let us mention also TENACITY of PURPOSE, which has held T E N A X F E L T S up to Highest Quality, for a record run of forty-two years.

"Non-Users Are The Losers"

LOCKPORT FELT COMPANY
NEWFANE, N. Y.



SHEAR CUT IS A CLEAN CUT

SAMUEL M. LANGSTON COMPANY

CAMDEN, NEW JERSEY

What are your liquid levels?

DO YOU KNOW? Are you certain every minute of the day and night just what the level of pulp, water, liquors and other process liquids is in tanks and chests?

Or do you have to go to a lot of bother to find out?

For these and similar applications there is nothing like BRISTOL'S Recording Liquid Level Gauge. Widely used for supplying continuous 24 hour chart records of liquid level, BRISTOL'S gauges not only tell what has occurred and is happening, but also serve as a guide to still better efficiency in daily routine.

Write for interesting literature.

THE BRISTOL COMPANY, WATERBURY, CONN.

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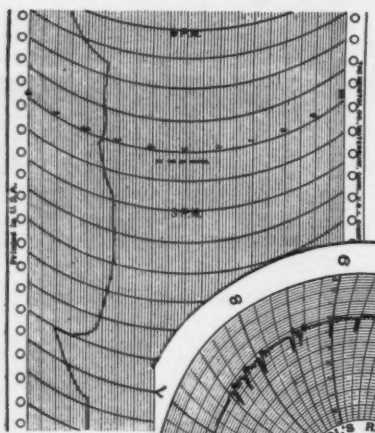
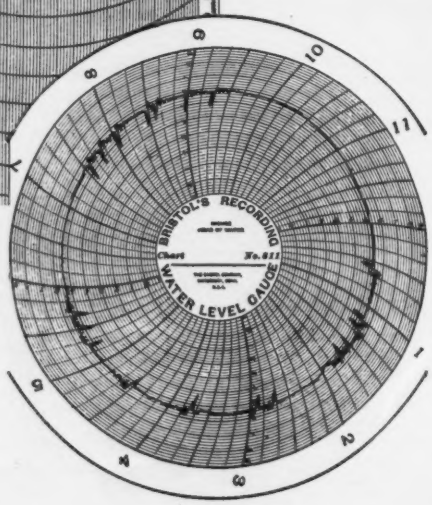


Below: Typical round chart record of level made by BRISTOL'S Recording Liquid Level Gauge. This chart is 8 inches in diameter and makes 1 revolution in 12 hours. Other charts 12 and 10 inches; speeds 24 hours and 7 days.



Above: Typical strip chart record of level. Chart 6 inches wide by 90 feet long. Speed to suit individual requirements.

TRADE MARK

BRISTOL'S

REG. U. S. PAT. OFF.

PIONEERS IN PROCESS CONTROL SINCE 1889

NATIONAL DYES

NATIONAL

TECHNICAL SERVICE

COMPETENT TECHNICIANS

IMMEDIATELY AVAILABLE

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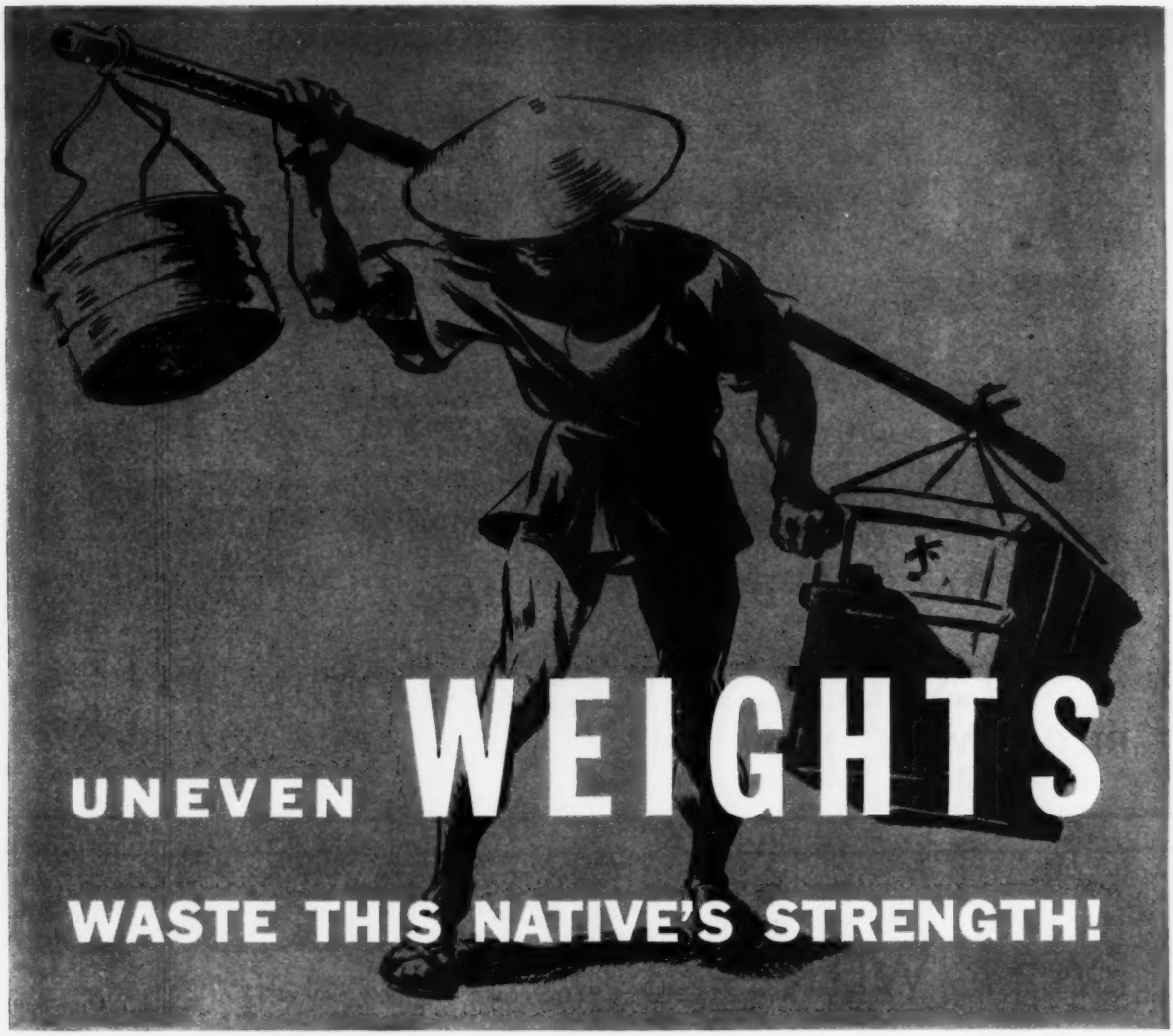


The same principle of uneven weights becomes a highly serious matter when it's applied to paper mill presses. How Taylor helps correct a costly situation.

THE NATIVE who still carries loads on both shoulders knows the penalty of uneven weight. Balance the loads and he carries on tirelessly.

What has this to do with paper mills? Just this: The same uneven weight adjustment causes plenty of trouble. It is the reason for uneven pressroll pressures that cost money and pull down stock quality. There is only one sure way to obtain the correct pressures. Eliminate guesswork in adjusting weights. Keep an accurate, hour-by-hour, day-by-day chart record of pressures at both ends of the press. The latest Taylor instrument for paper mills does this. It's the Taylor Pressroll Load Recorder.

Two years of operation in actual service have proved the economy and efficiency of this Taylor Recorder. It gave an opportunity for the first time to maintain uniform pressures across the entire width of the sheet, and, thus, to do these important things:

Increase the life of felt . . . do away with uneven frictional wear and reduce felt costs per ton from 5 to 10%.

Reduce steam cost per ton by removing water at the presses instead of the dryers.

Eliminate over-dried and under-dried edges and a cockled or grainy sheet, when caused by uneven pressures.

Assure uniformly high quality paper and produce it exactly according to specifications for finish, bulk, density, opacity and other characteristics.

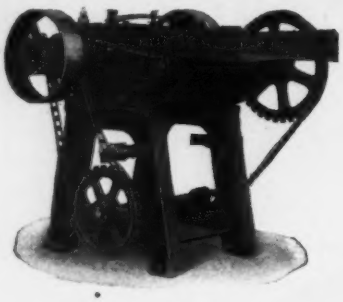
Taylor Pressroll Load Recorders have shown that, on the average, savings pay for them in a few months' time. Let us give you complete facts about this installation and its use in your mill. Address Taylor Instrument Companies, Rochester, N. Y., U.S.A., or Toronto, Canada.

Here is where the story of pressures is kept every hour of the day. This Taylor Load Recorder is durable and always accurate. Varations in pressures between the two ends of the press show at once in the difference between the readings of the two pens.

Taylor

Indicating Recording • Controlling

TEMPERATURE, PRESSURE *and* **FLOW INSTRUMENTS**



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FOR EVERY KIND OF PAPER STOCK

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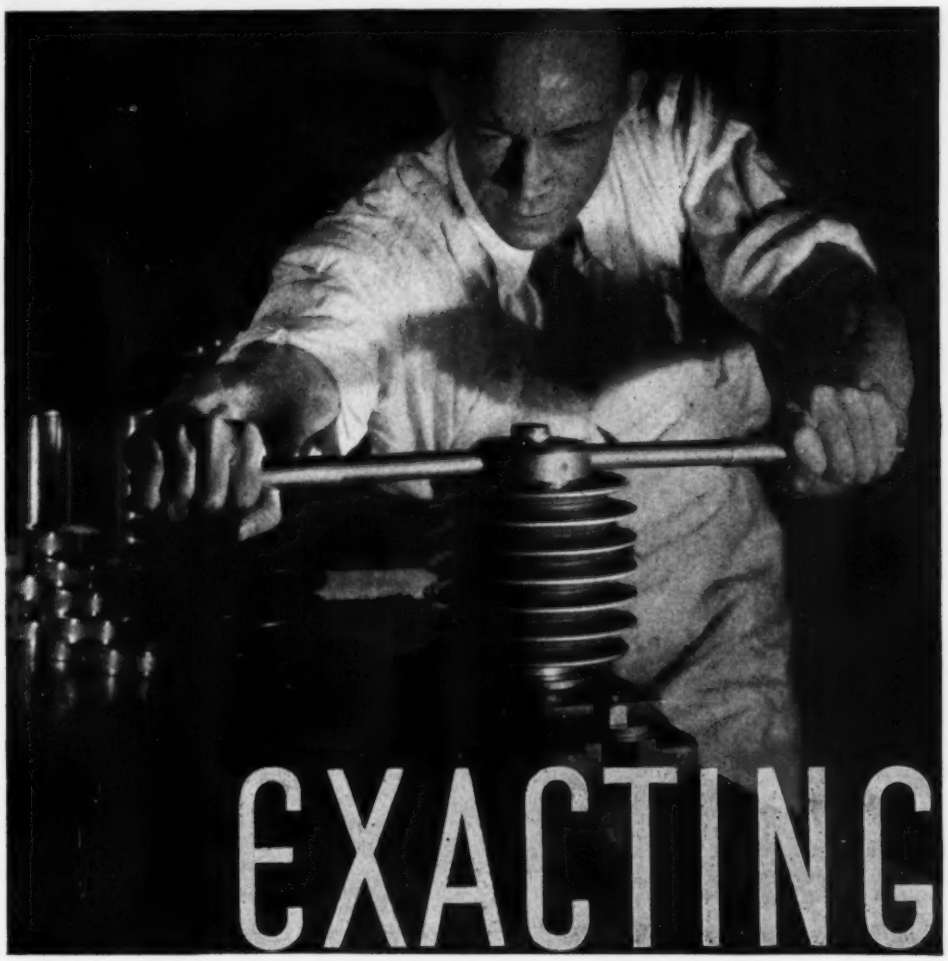

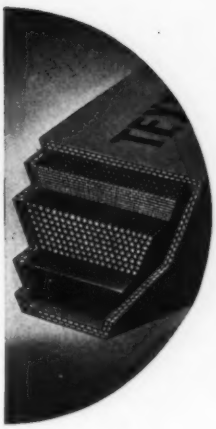

IT is when the going is toughest that Texrope Multiple V-belt Drives really prove how good they are, and how completely they measure up to every exacting test.

In the mining and rock-crushing industries, where power drives are subjected to severest strains, Texrope Drives are carrying the heaviest loads, and without a murmur.

In textile plants, where oil and dirt are frowned upon, Texrope Drives are as clean as a Dutch kitchen.

In laundries, paper mills, and refrigerating plants, where moisture is a handicap, Texrope Drives are giving steady and flawless service.

In hospitals, schools, courts, and office-buildings, where the least noise is tabooed, Texrope Drives are running so quietly you would not know they are moving.

Texrope Multiple V-belt Drives neither slip nor backlash, and so do away with all jerks and jars. Because there is no wear on sheaves, and practically none on the Texropes, replacements are infrequent. Their constant speed and low maintenance cost are bringing satisfaction to every user.

ALLIS-CHALMERS MFG. CO. MILWAUKEE, WIS.

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ORIGINATED BY ALLIS-CHALMERS

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PUSEY AND JONES
Wilmington, Delaware Corporation

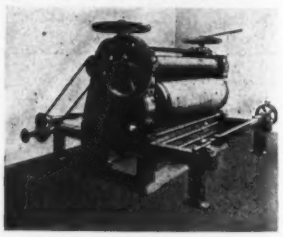
Speedier Operation *and* Less Waste

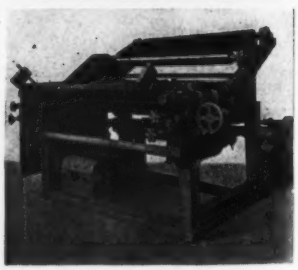
"Factory Modernization with time-saving, waste-eliminating machinery, will solve the production problem of the shorter working hours under NRA codes."

WALDRON MACHINES have always been especially designed to achieve greater output with reduced spoilage of materials. Under the new Code operating conditions, these two advantages in particular, are giving WALDRON Machines preference where shortened working hours present a production problem. WALDRON MACHINES now prove a better paying investment than ever before.

Let our engineers point out possible savings that can be effected under your present operating schedule. No obligation.

(Top) EMBOSSING MACHINE
(Center) COATING MACHINE





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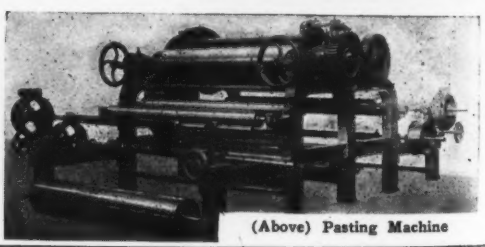


(Above) Pasting Machine

WHEREVER STEAM IS USED

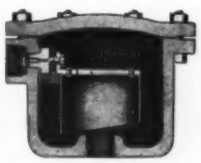
SEE THAT

STEAM LINES

are properly drained and trapped!

Crane Inverted Open Float Cast Iron Steam Trap for steam working pressures up to 200 lbs. Sizes ½″—¾″—1″

TRAP CLOSED



TRAP OPEN

This inexpensive little trap quickly pays for itself in the *automatic* removal of condensation from your steam lines. Without the Crane Inverted Open Float Steam Trap, water pockets accumulate. That brings water hammer, corrosion, heat losses, leaky valves, damaged coils and equipment. And the remedy of this trouble is so simple! Simply install the Crane Trap at all low points in the steam lines, steam units. They not only pay for themselves . . . they'll pay you back their cost over and over in a single year! Inspect your steam lines *now* and order a sufficient quantity of these inexpensive traps. They save steam . . . save coal . . . coal saved saves money! It's as simple as that!

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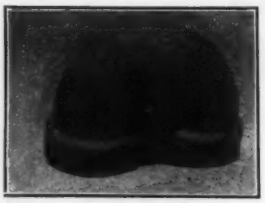
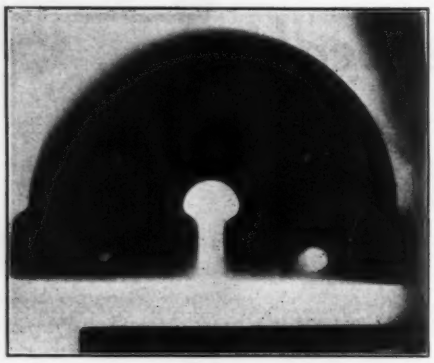


The Photograph Tells Nothing



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About the internal defects of castings.

Yet the photograph shows every defect visible to ordinary inspection.

DEMAND

X-Ray inspection of your chrome nickel castings.

THE ELECTRO ALLOYS CO.
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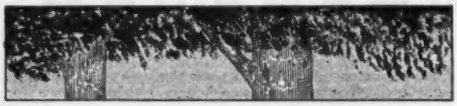
Thermalloy
X-RAYED CASTINGS FOR HEAT CORROSION ABRASION



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RUBBER LATEX
NORMAL-CONCENTRATED-PROCESSED

A reliable source of **LATEX** Supply and Service

Because raw latex is a variable material, it is essential to secure not only the most suitable form for the use required, but comparative standardization and uniformity as well. The Heveatex Corporation carry ample stocks of normal, concentrated and processed latex for immediate delivery.

Of particular interest today are the possibilities of converting waste materials and by-products or products selling at a low price into specialties selling at a higher price. New avenues for profitable production may be secured by utilizing the Heveatex plan whereby complete development projects are worked out through all the experimental stages. The complete process is delivered to manufacturers ready to set up for production.

Among the principal uses for latex in the fibrous products fields are saturation and impregnation of materials, compounds for the new combining machines, coatings, over-lappings, etc.

WE CARRY STOCK FOR THE BUYER.

Technical Correspondence Invited and Treated In Confidence.

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ESTABLISHED 1872

SIXTY-THIRD YEAR

THE INTERNATIONAL WEEKLY OF THE PAPER AND PULP INDUSTRY AND THE PIONEER PUBLICATION IN ITS FIELD

Published Every Thursday by the LOCKWOOD TRADE JOURNAL CO., Inc.

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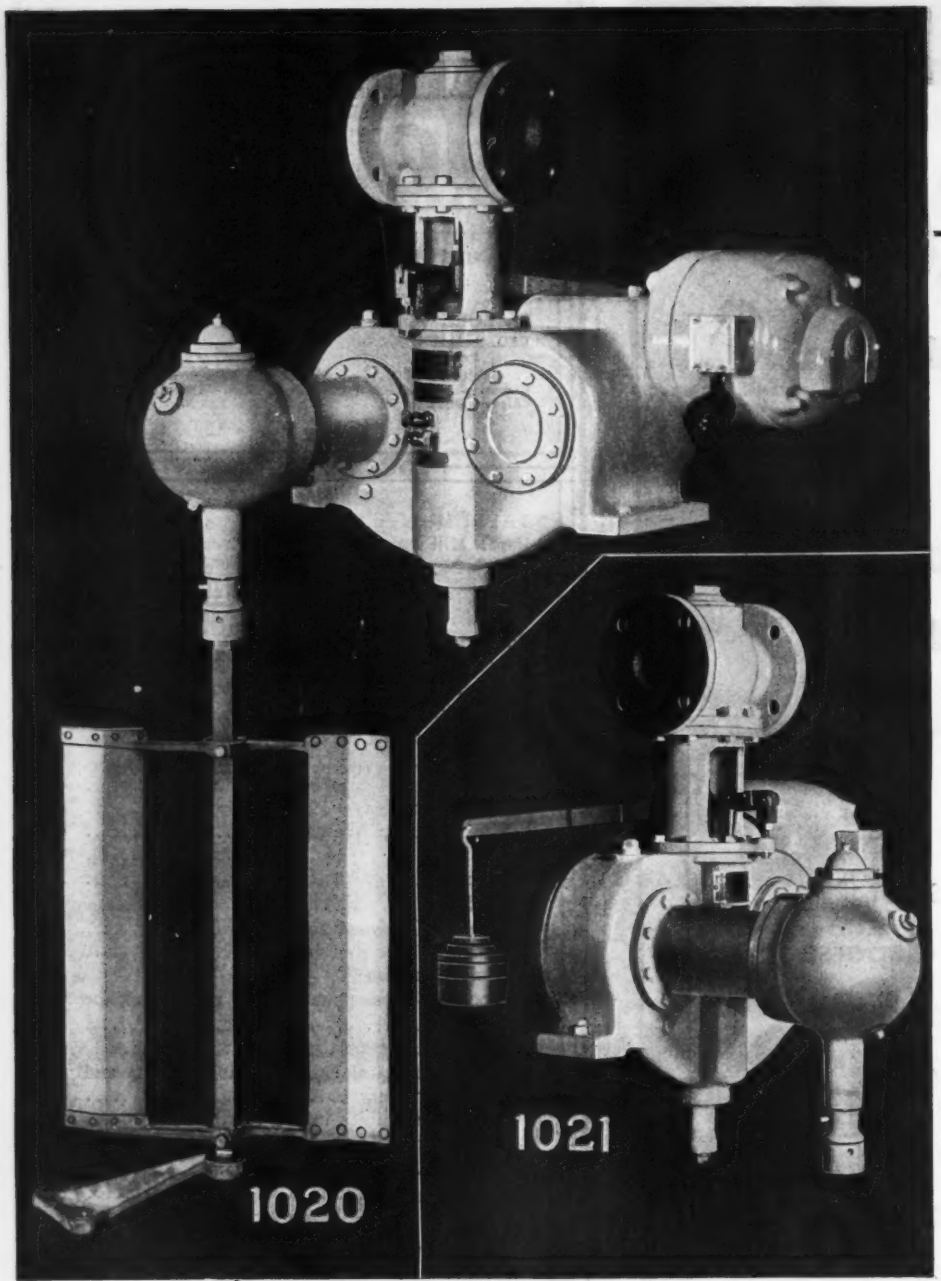

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PAPER TRADE JOURNAL

With Which Is Combined

Vol. XCIX, No. 12 PAPER Thursday, September 20, 1934

Technical Association Meets on Pacific Coast

Convention at Portland, Ore., Is Largely Attended, Visitors from Various Foreign Countries Giving the Meeting an International Aspect—Splendid Hospitality Is Provided by the Pacific Coast Section of TAPPI—Numerous Papers Presented on Topics of Timely Technical Interest—Exhibits Prove Interesting

[FROM OUR SPECIAL CORRESPONDENT]

PORTLAND, Ore., September 14, 1934—For the first time in its history the Technical Association of the Pulp and Paper Industry met on the Pacific Coast. The meeting headquarters was located at the Multnomah Hotel in Portland. About 500 members and guests registered and many more attended the various meetings and functions of the convention. The meeting was of an international character with delegates present from all the pulp and paper centers of the United States and Canada and representatives of Japan and the new papermaking countries of Australia and New Zealand.

The TAPPI Special

The congregating point for members of TAPPI from the East, South and Middle West was the Union Station in Chicago, out of which the TAPPI special train of the Northern Pacific Railroad pulled on Wednesday evening, September 5. Those on board enjoyed a pleasant and congenial train program under the leadership of G. S. Brazeau, C. H. Champion and Roger Egan. Various bridge and other tournaments were held on the train as it sped along over the bad lands of North Dakota and on to the Yellowstone Park where an all day tour was taken. Excellent weather added much to the enjoyment of the trip. At Mandan, N. D., Clark C. Heritage was made a member of the Sioux Tribe of Indians.

On Friday evening the party was entertained at the Davenport Hotel in Spokane, Wash., at a dinner dance and listened to brief interesting talks by Governor Clarence G. Martin of Washington, and W. E. Brazeau and M. W. Black of the Inland Empire Paper Company.

Real Western Reception

The TAPPI Special reached Portland on Sunday morning and was greeted with a Scottish Highland pipe band. Nearly everyone in Portland was out to see the delegates escorted from the station to the hotel; the officers of the Association and meeting chairmen were conveyed in a genuine old-time stage coach. President Heritage received the key to the city from Mayor Joe Carson of Portland, and was greeted by Mayor Jack Allen of Pendleton, where the famous roundup is held. The balance of the day was devoted to getting acquainted and sight seeing in Portland.

Local Organization

The tremendous success of the convention must be attributed to the enthusiastic enterprise and efforts of the local committee which was headed up by H. R. Heuer, general chairman. The details of the meeting were taken care of by committees under the chairmanships of the following: Administration—W. S. Hodges; Arrangements—John E. Hassler; Transportation—G. S. Brazeau; Reception—H. A. Des Marais; Publicity— Ray Smythe; Technical Program—R. S. Hatch; Mill Visits—A. G. Natwick; Ladies—Mrs. A. G. Natwick; Golf and Recreation —S. C. Rasmussen; and Entertainment—Fred A. Alsop.

Monday Morning Session

All of the meetings were held in the Assembly Room of the Multnomah Hotel. All sessions were opened by Lawrence Killam, chairman of the Pacific Section. C. C. Heritage of the Oxford Paper Company and President of TAPPI, presided at the first session as chairman.

The technical program was arranged to present both a local aspect and to draw attention to new developments. Monday morning and afternoon were devoted to the discussion of the following papers:

H. K. Benson, R. P. Irwin, J. R. Hendrickson and J. A. Tershin of the University of Washington, reported the results obtained from a series of cooks, in which Douglas fir was cooked in a five per cent ammonia base bisulphite liquor at a temperature below 70 deg. C. These experiments indicated that young Douglas fir approaches spruce and hemlock; that pretreated Douglas fir approaches spruce and hemlock; and that pulps made of old Douglas fir are of a distinctly lower order of quality.

Thornton T. Munger, Director of the Pacific Northwest Forest Experiment Station, gave a comprehensive report covering the availability of the principal species of pulp woods in the Northwest. Enough wood is available to meet the needs of the country in perpetuity.

Kraft Pulp Color

Walter F. Holzer of the Crown Willamette Paper Com-

pany, Camas, Wash., presented a paper on "A Study of the Coloring Matter in Pine Kraft Pulps." This paper was based on his doctorate thesis at the Institute of Paper Chemistry, Appleton, Wis. When wood is cooked by the kraft process, the resulting pulp has a characteristic red brown color. This coloring matter was extracted by the author who found that the chemical characteristics of the coloring matter are similar to those of the phlobotannius and is probably a sulphur derivative and is acidic in nature.

Color in West Coast Hemlock

C. E. Curran of the Forest Products Laboratory, Madison, Wis., reported that the phlobotannius or their derivatives, the phlobophenes, are found in considerable quantity in the ray cells of Western Hemlock and are believed responsible for the dark color frequently encountered in groundwood pulp made from this wood.

Heat Transfer

Charles S. Keevil of Oregon State College read a paper on "Heat Transmission." In this paper he reviewed the principles of heat transfer, in particular as they relate to sulphur burners, digesters, driers, etc.

A paper by M. W. Phelps, assistant manager of Pacific Mills Ltd., Ocean Falls, B. C. was read on "Technical Control in Pulp and Paper Manufacture." This was an excellent survey of the work of the mill technical department.

Luncheon Program

The first luncheon program was featured by an adddress by D. B. Dodson, Executive Vice President, Portland Chamber of Commerce," on "Potential Power Resources in the Northwest and Their Relation to the Pulp and Paper Industry." In this talk Mr. Dodson described the work being done by the Public Works Administration at Bonneville, Wash., and the future plans for developing the power sites of the Columbia River. A low power rate is expected to attract the power using industries. C. W. Morden past chairman of the Pacific Section, presided at this luncheon as toastmaster.

Monday Afternoon Session

The Technical program was continued after lunch with M. W. Black, vice chairman of the Pacific Session presiding.

CLARK C. HERITAGE
President of the Technical Association

C. C. Hockley, State Engineer for Oregon for the Public Works Administration continued the discussion started by Mr. Dodson on the Northwest power possibilities. He pointed out that the Northwest has one-third of the potential water power of the United States. This is expeced to be developed and utilized.

Sulphite Tower Absorption Theory

W. L. Beuschlein and Frank H. Conrad of the University of Washington read a paper on "The Theory of Absorption Applied to the Sulphite Tower." In this paper the role played by the several fluid films which control the absorption of sulphur dioxide was analyzed. Dr. Beuschlein also discussed "The System CaO-SO_2-H_2.

Stainless Steel Castings

E. G. Swigart, vice president of the Electric Steel Foundry Company, Portland, Ore., discussed "The Casting Problems of Stainless Steel." In this paper the differences between a cast and a rolled article lies in the crystalline nature of the steel. Great care must be exercised in the design and manufacture of corrosion resisting steels.

Hog Fuel Burning

H. S. Bastian of the Combustion Engineering Company, Portland, Ore., described the "Design and Operation of Hog Fuel Burning and Handling Equipment." Furnaces of the Dutch oven type were shown to be well adapted to this work.

Ralph Smalley, vice president of the Washington Gas and Electric Company, Longview, Washington, described the "14 Inch Steam Line between the Washington Gas and Electric Company's plant and the Longview Fibre Company's mill at Longview, Washington."

An interesting feature of this program was a talk by W. H. Goodenough of Hood River, Ore., on his experience as a paper maker for fifty years.

President's Dinner

One of the most attractive social features of the meeting was the dinner tendered the President, Clark C. Heritage. Nearly every executive and technical man together with friends attended this colorful affair during which a splendid musical entertainment was enjoyed. The toastmaster was Franklin T. Griffith president of the Portland Electric Power Company. Senator Allen Bynor represented Mayor Carson in an address of welcome to the visitors. George L. Baker, former mayor discussed industry in the Northwest.

The principal speaker was Marshall N. Dana, chairman of the regional planning committee of the P. W. A. who told of the Northwest's vast resources, declaring that the Government's program of planned production with attendant development of water power will start a hegira of business and home seekers to the Northwest within a few years.

Weyerhaeuser Woods Trip

The event which was undoubtedly the highlight of the convention was the visit by about 200 members to the woodlands operations of the Weyerhaeuser Timber Company at Longview, Wash. A full day was devoted to this trip, most of which was spent on the Paul Bunyan Express, a high speed train that was equipped with flat cars that provided an opportunity for everyone to view these magnificent timber stands.

Among the many interesting sights seen was the following: Engine 201, the 497,000 pound locomotive, the largest in the logging service; the Lidgerwood tower skidder. This machine yards and loads logs within a radius of 1,800 feet. The tower is 105 feet high, supporting a two-inch "sky line" cable on which a travelling

carriage runs leading the skidding lines. The sky line is supported at the rear of the logging area by a spar tree, topped and guyed by cables. The crew of this machine is 22 men.

Timber falling and spear tree topping were demonstrated by expert loggers who scaled these high trees, aided only by spurs and a rope.

A bounteous lunch was enjoyed at Camp 5 and an opportunity was given to inspect a modern lumber camp. In the afternoon the party was taken to the virgin timber stands and saw the railroad construction work which was going on.

Following the woods visit many inspected the pulp mill of the Weyerhaeuser Timber Company. Records showing all variables which affect the quality or uniformity of the products that have been assembled at the plant are placed in chart form, showing an up-to-date history of operations, was at the disposal of the visitors.

The timber trip utilized the entire day so technical paper presentations at the Multnomah were dispensed with. In the evening there was a stag party and reception by Paul Bunyan and his "blue ox" at the Congress Hotel. This included a hunt for the famous "Goofus bird." The setting was intended to represent Paul Bunyan's stable and ox pasture.

Ray Hatch of the Weyerhaeuser Timber Company was chairman of the Wednesday morning sessions.

Consistency Regulation

Frederick Wierk of Johnson & Wierk Inc., New York, N. Y., talked on "Consistency Regulation." This was a discussion of the fundamentals involved. The author pointed out that all commonly used consistency regulators employ, as the regulatory attribute, the viscosity of the suspension which is under their control. The various regulators on the market were classified as being of the mechanical or hydraulic types. The operating principles of these were described.

Pulp Specifications

Miss Helen U. Kiely of the American Writing Paper Company, Holyoke, Mass., and H. C. Schwalbe of Dill & Collins, Inc., Philadelphia, Pa., reported the results obtained from a series of cooperative tests. It was made evident that the industry is not as yet ready to adopt specifications for pulp.

Electrical Equipment

R. V. Maier of the General Electric Company, Portland, reviewed the applications of electrical operating and control equipment in the modern paper mill. This includes sectional drives, steam turbine line shaft drives, Selsyn devices, vacuum tubes, air circuit breakers, etc.

E. H. Vicary and K. L. Howe of the Westinghouse Electric and Manufacturing Company, described the design, application and safety features of the cubicle type control for squirrel cage, synchronous and wound rotor motors.

New Sulphur Burner

The results obtained from operating the new Texas Gulf Company spray type sulphur burner was reported by W. H. Swanson of the Kimberly Clark Corporation, Neenah, Wis. High operating efficiency was indicated.

Visit to Camas

Wednesday afternoon was devoted to a visit to the Camas mill of the Crown Willamette Paper Company.

The luncheon program featured Ray Smythe of Portland, who presented an interesting and humorous address on "A Business Forecast of the Future Based on a Study of Planetary Influences," from the book "Stars Ahead." The talk was accompanied by illustrative slides.

H. ROBERT HEUER
General Chairman TAPPI Convention Committee

In the evening nearly 500 people taxed the capacity of the Arabian Room at the cabaret where an excellent vaudeville and dancing program was enjoyed. Motion pictures showing interesting highlights and personalities of the westward trip were shown.

The Thursday program began with the presentation of a series of papers as follows:

Zinc Sulphide Fillers

F. A. Steele of the New Jersey Zinc Company, Palmerton, Pa., demonstrated the use of zinc sulphide pigments in products such as boxboard liners and waxed papers.

Influence of pH in Dyeing

V. Kuykendall read a paper on "The Effect of pH upon the Adsorption of Dyes by Cellulose Fibers." Studies of the adsorption of methylene blue upon cellulose, Kaolin and talc show that the process is true adsorption since it follows the Freundlich adsorption law.

William Gibson, chief engineer of the Rainier Pulp and Paper Company, Shelton, Wash., discussed "Maintenance and the Technical Man."

Lee H. Place, engineering supervisor of the Air Reduction Sales Company, Portland, Ore., read a paper on "Metalayer Operation as Applied to the Pulp and Paper Industry."

Local Section Election

At the close of the technical session the local Pacific Section convened under the chairmanship of Lawrence Killam. The by-laws of the Section were amended to provide for the election of two vice chairmen instead of one. M. W. Black of the Inland Empire Paper Company, was elected chairman; E. W. Barber of the Camas mill of the Crown Willamette Paper Company and Lee Burdon of the Soundview Pulp Company were elected vice chairmen and W. S. Hodges of Portland, was elected secretary-treasurer.

Farewell Dinner

A golf tournament for men was held at the Portland Golf Club, the winners of which received prizes at the Farewell Dinner in the evening. Ralph Shaffer, president of the Shaffer Pulp Company presided as chairman. Dur-

ing the dinner motion pictures of the Weyerhaeuser Woods Visit were shown by the photographer, Roger Egan of the Bulkley-Dunton Company, Chicago, and were explained by Chuck Champion of R. T. Vanderbilt Company, New York.

Exhibits

The following companies had interesting exhibits on display:

The Chromium Corp. of America, Milwaukee, Wis.

Pacific Coast Supply Company, San Francisco, Calif. Including:—

Eastwood Nealley Corporation; F. C. Huyck & Sons; Texas Gulf Sulphur Company; Heller & Merz Corporation; California Cotton Mills Company; E. D. Jones & Sons Company; The Norton Company; Jos. J. Plank & Company.

Morden Machines Company, Portland, Ore.

Vaughan Motor Company—Portland.

Kenneth B. Hall—Portland. Representing Improved Paper Machine Corporation; Huntington Rubber Mill; Noble and Wood Machine Company; Kirkwood Log Barker.

General Electric Company, Schnectady, N. Y.

Western Gear Works and Pacific Gear & Tool Works, Seattle, Wash.

R. M. Wade & Co., Portland.

C. C. Moore & Co.—San Francisco, Cal. Representing: The Cochrane Corp.

The Carborundum Company, Niagara Falls, N. Y.

Associated Oil Company, San Francisco, Cal.

The Bristol Company, Waterbury, Conn.

Westinghouse Electric and Manufacturing Company, East Pittsburgh, Penn.

Walworth Company, Portland, Ore.

Air Reduction Sales Company, Portland Ore.

Gladding McBean & Company—Portland, Ore.

Smith Iron Works, Portland, Ore.

Edgar Bros. Company—New York, N. Y. (Part of Gladding McBean).

Link Belt Company, Portland, Ore.

Great Western Electrochemical Company, Seattle, Wash.

Nash Engineering Company, Newark, N. J.

The Foxboro Company, Portland, Oregon.

Electric Steel Foundry Company, Portland, Ore.

Columbia Steel Company, Seattle, Wash.

Johns Manville Sales Corporation, with Goodyear Rubber & Asbestos Company, New York, N. Y.

Rex Chain Belt Company.

Oliver United Filters, San Francisco, Cal.

Bagley & Sewall Company, Watertown, N. Y.

B. F. Perkins & Sons, Inc., Holyoke, Mass.

Donald M. Thompson Co., Representing: The Farual Corp.; American Flexible Coupling Co.; Cleveland Worm & Gear Co.

Keystone Lubricating Company, Philadelphia, Pa.

The Crane Company, Chicago, Ill.

The Potdevin Machine Company, Brooklyn, N. Y.

The Sumner Iron Works, Everett, Wash.

The Pacific Pulp and Paper Industry, Seattle, Wash.

H. P. Scheel, Jr.

Ladies' Program

Under the guidance of Mrs. A. G. Natwick and her co-workers, the ladies who attended the meeting enjoyed a very interesting program. On Monday there was a sight seeing trip in Portland and vicinity. On Tuesday there was a bus trip up the Columbia River and around Mount Hood. Lunch was had at the Columbia Gorge Hotel. Later in the afternoon tea was served at Battle Axe Inn. In the evening many attended theatre parties.

On Wednesday buses left the Multnomah Hotel for a trip over the Evergreen Highway in Washington, crossed the Columbia River over the "Bridge of the Gods," to the Columbia River Highway in Oregon to a tea party at the famous country estate of Governor and Mrs. Julius L. Meier.

On Thursday there was a ladies' golf tournament at the Oswego Country Club. The ladies met jointly with the men at a number of banquets, luncheons, cabarets, etc.

International Aspect

In addition to the many from the United States and Canada who attended, there were representatives of Australia, Japan and Great Britain.

Those Who Attended

Among those who attended were the following:

C. E. Ackley, Grays Harbor Pulp & Paper Co.; Fred E. Alsop, Van Waters & Rogers Co., American Pulp & Paper Association; H. Andrews, Powell River Co., Ltd.; J. H. Angwine, Crane & Co.; F. R. Armbruster, Weyerhaeuser Timber Co.; G. J. Armbruster, Soundview Pulp Co.

C. L. Bachelder, Paper Makers Chemical Corp.; Eber W. Badcon, Takahashi and Co., C. T.; C. M. Baker, American Pulp & Paper Association; W. E. Byron Baker, Castanea Paper Co.; Walter Bain, Crown Willamette Paper Co.; Albert Bankus, Crown Zellerbach Corp.; Thos. J. Bannan, Western Gear Works; W. W. Barrett, Carborundum Co.; R. S. Beall, New Jersey Zinc Sales Co.; E. N. Bechard, Eastwood Nealley Corp.; H. W. Beecher, Moore & Co., C. C.; Louis R. Benjamin, Derwent Valley Paper Co., Ltd.; Henry K. Benson, Univ. of Washington; A. W. Berggren, Shaffer Pulp Co.; W. L. Beuschlein, Univ. of Washington; C. F. Beyerl, Pacific Sales Co.; A. L. Bibbins, Elec. Steel Foundry Co.; L. K. Bickell, B. C. Pulp and Paper Co.; Myron W. Black, Inland Empire Paper Co.; L. M. Booth, Booth Chemical Co.; Geo. W. Bowers, Consolidated Supply Co.; J. C. Bowman, S. K. F. Industries, Inc.; Carl E. Braun, Hawley Pulp & Paper Co.; G. S. Brazeau, Weyerhaeuser Timber Co.; G. S. Brett, Castle, A. M. Co.; Martin Brewer, du Pont Co.; G. C. Brewster, Northwest Screen Spec. Wks.; Harry A. Brod, Sturtevant Co., B. F.; Harvey E. Brown, New Jersey Zinc Co.; Harold H. Burrows, Manhattan Rubber Mfg. Co.; F. W. Barrette, Associated Oil Co.; E. J. Bartells, E. J. Bartells Co.; Dr. H. K. Benson, University of Wash.; C. E. Buckner, Electric Steel Foundry Co.; Leo S. Burdon, Soundview Pulp Co.

Olin W. Callighan, Edgar Bros. Co.; Roy Carey, National Aniline & Chem. Co.; C. P. R. Cash, St. Helens Pulp & Paper Co.; O. S. Cauvel, Washington Pulp & Paper Co.; C. H. Champion, R. T. Vanderbilt Co.; James Cole, Gladding, McBean & Co.; E. F. Clark, L. F. Butcher Co.; Willis E. Clark, Gladding, McBean Co.; Arthur A. Coffin, Titanium Pigment Co.; Sidney M. Collier, Soundview Pulp Co.; G. N. Collins, International Paper Co.; Chas. S. Conrad, Columbia Steel Co.; E. W. G. Cooper, Crown Willamette Paper Co.; F. L. Cooper, Braun-Knecht-Heimann Co.; Darrah Corbet, Morden Machine Co.; John Cornell, The Paper Mill; N. W. Coster, Soundview Pulp Co.; D. E. Cousins, Crown Willamette Paper Co.; A. H. Cox, A. H. Cox & Co.; J. V. B. Cox, Papermakers Chem. Corp.; J. W. Cronin, Krebs Pigment & Color Corp.; B. D. Cruikshank, Walworth Co.; T. C. Culver, Corn Products Sales Co.; L. L. Cunningham, Minneapolis Honeywell Regulator Co.; C. E. Curran, Forest

Products Laboratory; A. M. Cadigan, Rainier Pulp & Paper Co.; R. E. Chase, R. E. Chase & Co.; Wm. W. Clarke, Longview Fibre Co.; Walter Clifford, Penwick F. Ford Sales Co.

Henry W. Dauterman, Longview Fibre Co.; B. W. Dean, E. D. Jones & Sons Co.; H. A. Des Marais, General Dyestuffs Corp.; C. P. Dee Reamer, Crane & Co.; E. G. Drew, J. O. Ross Engnieering Co.; Alec C. Duncan, Paper Makers Chemical Corp.; A. C. Dunham, Lockport Felt Co.; Carl J. Dupuis, Longview Fibre Co.; G. F. Durand, Port Huron Sulphide & Paper Co.; Minot Davis, Weyerhaeuser Timber Co.; W. E. Dornbach, General Refractories Co.

Roger J. Egan, Bulkley Dunton & Co.; Frank B. Ellers, Orr Felt & Blanket Co.; E. Ekholm, Puget Sound Pulp & Timber Co.; K. I. Ekholm, Nat. Aniline & Chem. Co.

J. P. V. Fagan, Puget Sound Pulp & Timber Co.; Carl Fahlstrom, Longview Fibre Co.; Lyle G. Fear, Westinghouse Elec. & Mfg. Co.; W. Grant Fiske, Thames Board Mills; Jas. Foxgrover, Paper Makers Chem. Corp.; Frank D. Frampton, Hopper Paper Co.; A. F. Frances, Chromium Corp. of America; M. H. Freidman, Columbia Steel Co.; Harold F. Fretz, Olympic Forest Products Co.; Uno G. Fryklund, St. Helens Pulp & Paper Co.

Ben Gellenbeck, Keystone Lubricating Co.; F. C. Gevers, Longview Fibre Co.; F. C. Gibson, Edison Storage Battery Supply Co.; E. P. Gleason, Nekoosa Edwards Paper Co.; W. H. Goodenough, Retired Paper Mill Superintendent; John C. Mannion; W. W. Griffith, St. Regis Paper Co.; F. W. Guernsey, Texas Gulf Sulphur Co.; H. M. Gustafson, General Electric Co.; A. S. Gerry, Weyerhaeuser Timber Co.; Wm. R. Gibson, Rainier Pulp & Paper Co.; L. T. Graham, Link Belt Co.; Thomas W. Grant, Crown-Willamette Paper Co.; O. W. Greenwalt, Rainier Pulp & Paper Co.

Kenneth B. Hall, Improved Paper Machine Corp.; John Hamm, Shartle Bros. Machine Co.; I. R. Harcourt, Fibreboard Products, Inc.; Tom Hargraves, Washington Pulp & Paper Co.; H. H. Harrison, Crystal Tissue Co.; John E. Hassler, Simonds, Worden White Co.; Raymond S. Hatch, Weyerhaeuser Timber Co.; H. A. Hauff, Weyerhaeuser Timber Co.; Edward A. Heiss, Wallace & Tiernan Co.; H. A. Helder, Champion Fibre Co.; J. W. Hemphill, Johns Manville Sales Corp.; C. T. Henderson, Westraco Chlorine Products, Inc.; E. C. Hendrickson, Mead Corp; Dr. F. R. Henry, Simonds, Worden White Co.; C. C. Heritage, Oxford Paper Co.; H. Robert Heuer, Weyerhaeuser Timber Co.; Walter S. Hodges, Appleton Wire Works; E. F. Huckstep, General Chemical Co.; W. F. Hynes, General Electric Co.; T. E. Heppenstall, Long Bell Lumber Sales Corp.; Dr. W. Hirschkind, Great Western Electrochemical Co.; W. A. Howe, Westinghouse Elec. & Mfg. Co.

Richard Jennings, Griffith Rubber Mills; Edwin C. Jahn, University of Idaho; Roy B. Johns, Freeport Sulphur Co.; Alex Johnson, Provincial Paper, Ltd.; Carl G. Johnson, General Paint Corp.; Marvin C. Jones, Michigan Carton Co.; W. D. Jorres, L. H. Butcher Co.; H. Jungerman, C. J. Tagliabue Mfg. Co.; H. L. Joachim, U. S. Gypsum Co.; O. A. Jorgenson, B. C. Pulp & Paper Co.

PICTURE TAKEN AT TAPPI PRESIDENT'S DINNER, PORTLAND, ORE., SEPTEMBER 10, 1934.

William Pitt Kellogg, Air Reduction Sales Co.; W. A. Kelly, Waterbury Felt Co.; W. N. Kelly, Weyerhaeuser Timber Co.; P. B. Keyes, Goodyear Rubber & Asbestos Co.; C. J. Kern, The Moore & White Co.; Mr. B. L. Kerns, Westinghouse Elec. & Mfg. Co.; Ernie E. Kertz, Simonds Worden White Co.; W. S. Kidd, E. B. Eddy Co., Ltd.; Helen U. Kiely, American Writing Paper Co.; L. Killam, B. C. Pulp & Paper Co.; Shinji Kimura, Mitsubishi Paper Mills, Ltd.; Dr. Maurice E. Kinsey, Rainier Pulp & Paper Co.; E. P. Klund, Hammermill Paper Co.; Paul Koenig, P. H. Glatfelter Co.; F. J. Kranhold, Kimberly Clark Corp.; D. Vernon Kuykendall, Jr., Oregon State College.

Jack E. Lackner, The Texas Co.; James A. Lane, Oliver United Filters; Mrs. E. C. Lathrop, Crown Willamette Paper Co.; Byron E. Lauer, Northern Paper Mills; O. L. Le Roux, Hennepin Paper Co.; H. V. Lethlean, Derwent Valley Paper Co.; N. A. Lewthwaite, National Paper Pro. Co.; H. Liebeck, Scott Paper Co.; Hylton A. Long Carburundum Co.; J. G. Long, Crown Willamette Paper Co.; H. H. Lowey, Columbia Steel Co.; A. H. Lundberg, G. D. Jenssen Co.

R. V. Maier, General Electric Co.; R. G. MacDonald TAPPI; D. J. MacLaurin, B. C. Pulp & Paper Co., Ltd.; John C. Mannion, Grays Harbor Pulp & Paper Co.; Bill Marshall, Heller & Merz Corp.; Hoke Martin, Mathieson Alkali Works, Inc.; R. B. Martin, Wallace & Tiernan Co.; John J. McDonald, Brown Co.; W. J. McGinnis, Pac. Coast Supply Co.; Archibald McClintock, Texas Gulf Sulphur Co.; Wm. M. McNair, Weyerhaeuser Timber Co.; John McVicker, Standard Oil Co. of Calif.; Geo. S. Meddis, Simonds Worden White Co.; G. A. Macklem, Beloit Iron Works; Ned. Menzies, W. S. Tyler Co.; A. D. Merrill, Chemipulp Process, Inc.; A. W. Miller, Cornell Wood Products Co.; H. Norman Miller, Westinghouse Elec. & Mfg. Co.; B. D. Millidge, Howard Smith Paper Mills; Geo. W. Mitchell, Wallace & Tiernan Sales Corp.; T. E. Moffitt, Hooker Electrochemical Co.; C. W. Morden, Morden Machines Co.; Harold Murdock, Champion Fibre Co.; A. D. Myers, Balfour Guthrie & Co., Ltd.

A. G. Natwick, Crown Willamette Paper Co.; G. W. E. Nicholson, Southern Kraft Corp.; W. A. Nivling, Huron Milling Co.; Sigurd Norman, Sumner Iron Works; Edward H. Nunn, Crown Willamette Paper Co.; Chip Nagle, Hyatt Roller Bearing Co.; E. A. Norton, Hawley Pulp & Paper Co.

Ernest O'Connor, Fibreboard Products, Inc.; H. B. O'Heir, Canadian International Paper Co.; James Q. Osborne, De Laval Steam Turbine Co.; W. M. Osborne, Hooker Electrochemical Co.; John R. Owen, Northwest Lead Co.; F. L. Odom, Hawley Pulp & Paper Co.

R. S. Painter, Idaho Lime Co.; C. H. Pape, Independent Foundry Co.; W. D. Parker, C. J. Tagliabue Mfg. Co.; E. E. Perso, The Texas Co.; Herbert Peterson, Weyerhaeuser Timber Co.; R. T. Petrie, Bagley & Sewall Co.; Lee H. Place, Air Reduction Sales Co.; Wm. A. Prier, Oregon Brass Works; Wm. Pripp, Federal Pipe & Tank Co.

Albert S. Quinn, Stebbins Eng. & Mfg. Co.

J. G. Ramsey, Everett Pulp & Paper Co.; E. R. Rasmussen, Consolidated Supply Co.; S. C. Rasmussen, General Paint Co.; H. J. Reavis, Staley Sales Corp.; Lew Reed, Escanaba Paper Co.; Ralph Reid, Spaulding Pulp & Paper Co.; J. F. Rhoades, Mead Corp.; H. H. Richmond, Electric Steel Foundry Co.; Julian Richmond, Potdevin Machine Co.; J. H. Richmond, Potdevin Machine Co.; Carl F. Richter, Stebbins Eng. & Mfg. Co.; Cliff M. Rogers, Woodbury & Co.; Nat. S. Rogers, Van Waters & Rogers; L. R. Ruch, Marshall Wells Co.; P. J. Reeves, Timken Roller Bearing Co.; H. Reimer, Hawley Pulp & Paper Co.; J. G. Richards, Van Waters & Rogers, Inc.; D. D. Roberts, National Lead Co.

S. A. Salmonson, Crown Willamette Paper Co.; P. Sandwell, Vancouver, B. C.; M. E. Sanford, Fibreboard Products, Inc.; B. W. Sawyer, Foxboro Co.; R. J. Schadt, Crown Willamette Paper Co.; H. F. Schenk, Wm. A. Hardy & Sons Co.; L. Scheuerman, Cameron Machine Co.; John Schibel, Log De Barking & Sizing Corp.; R. W. Schneider, Morrison Hotel; H. C. Schwalbe, Dill & Collins, Inc.; Harlan Scott, Pacific Pulp & Paper Industry; H. Liebeck, Scott Paper Co.; C. R. Seaborne, Thilmany Pulp & Paper Co.; Ralph Shaffer, Shaffer Pulp Co.; F. C. Shaneman, Tacoma Electrochemical Co.; J. M. Shedd, Everett Pulp & Paper; Brian Shera, Tacoma Electrochemical Co.; Tom Shields, Simonds Saw & Steel Co.; Don L. Shirley, Link Belt Co.; Chas. A. Shubert, Dill & Collins, Inc.; Paul Shuey, Johns-Manville Sales Corp.; R. H. Simmons, Govt. Ptg. Office; Randolph Simpson, Electric Steel Foundry; L. E. Smith, Nekoosa-Edwards Paper Co.; Lawrence K. Smith, Pacific Pulp & Paper Industry; Ray Smythe, Portland, Ore.; J. L. Somerville, Serwent Valley Paper Ptg., Ltd.; George K. Spence, Castanea Paper Co.; Homer E. Stafford, Hawthorne Paper Co.; Sally Stephan, Pacific Coast Supply Co.; Mrs. C. F. Stevey, Crown Willamette Paper Co.; A. G. Stone, International Paper Co.; E. Sutermeister, S. D. Warren Co.; Walter H. Swanson, Kimberly-Clark Corp.; Ferdinand Schmitz, Rainier Pulp & Paper Co.; Ernst Schweitz Hawley Pulp & Paper Co.; Kenneth Shibley, Shibley & Co.; Anton P. Siebers, Longview Fibre Co.; N. F. Silver, Weyerhaeuser Tbr. Co.; L. W. Smith, Hawley Pulp & Paper Co.; R. D. Sollars Associated Oil Co.; H. H. Stilwell, Albany Felt Co.

A. Ward Tedrow, Western Bureau of Paper Stds.; Earl G. Thompson, Great Western Elec. Corp.; John Traquair, Mead Corp.; Donald W. Thomson, Donald W. Thomson & Co.

H. A. Vernet, Staley Sales Corp.; A. S. Viger, Rainier Pulp & Paper Co.

Ralph Waldo, National Aniline & Chemical Co.; T. J. Waltmon, Ohio Knife Co.; John F. Weillen, Grays Harbor Pulp & Paper Co.; R. L. Weldon International Paper Co.; Fred J. Weleber, Hawley Pulp & Paper Co.; R. S. Wertheimer, Longview Fibre Co.; V. B. Wilfley, H. N. Miller; Frank H. Wheelock, Fibreboard Products, Inc.; M. M. Whitman, Marathon Paper Mills; A. W. Wickham, McAndrews & Forbes Co.; W. R. Wiell, Pacific Coast Supply Co.; C. F. Weiss, College Puget Sound; Z. A. Wise, Griffith Rubber Mills; Robert B. Wolf, Jr., Crown Willamette Paper Co.; Frederick Wierk, Johnson & Wierk, Inc.; Vernon B. Wilfley, Westinghouse Elec. & Mfg. Co.; Bill Williamson, Shuler & Benninghofen; A. D. Wood, Shaffer Pulp Co.

Arthur G. Young, Balfour Guthrie & Co., Ltd.

A. Zimmerman, Pacific Straw, Paper & Board.

Ladies in Attendance

Mrs. Fred Alsop, Portland, Ore.

Mrs. Thos. J. Bannan, Seattle, Wash.; Mrs. E. N. Bechard, Belleville, N. J.; Mrs. F. M. Benjamin, Tasmania, Australasia; Mrs. A. W. Tacoma, Wash.; Miss Selma Blair; New York, N. Y.; Mrs. Carl E. Braun, Oregon City, Ore.; Mrs. G. S. Brazeau, Chicago, Ill.; Mrs. Martin Brewer, San Francisco, Cal.; Mrs. Mabel Brewster, Shelton, Wash.; Miss Brewster, Shelton, Wash.; Helen E. Burrows, Passaic, N. J.

Mrs. A. M. Cadigan, Shelton, Wash.; Mrs. Olin W. Callighan, New York, N. Y.; Mrs. Roy S. Carey, Portland, Ore.; Mrs. O. S. Cauvel, Port Angeles, Wash.;

Mrs. E. F. Clark, Seattle, Wash.; Mrs. Sidney M. Collier, Everett, Wash.; Mrs. G. N. Collins, Scarsdale, N. Y.

Mrs. H. A. Des Marais, Portland, Ore.; Mrs. A. C. Duncan, Portland, Ore.

Mrs. R. L. Earnheart, Portland, Ore.; Mrs. Frank B. Eilers, Kalamazoo, Mich.; Marie Ekholm, Bellingham, Wash.

Mrs. Carl Fahlstrom, Longview, Wash.; Mrs. Neta Frampton, Taylorville, Ill.; Miss Elsie Frundt, New York, N. Y.

Mrs. A. S. Gerry, Longview, Wash.; Mrs. E. P. Gleason, Port Edwards, Wis.; Mrs. L. T. Graham, Seattle, Wash.; Mrs. O. W. Greenwalt, Shelton, Wash.; Mrs. W. W. Griffith, Tacoma, Wash.

Mrs. Kenneth B. Hall, Portland, Ore.; Mrs. H. H. Harrison, Middletown, Ohio; Mrs. John E. Hassler, Portland, Ore.; Mrs. R. S. Hatch, Longview, Wash.; Mrs. H. A. Hauff, Longview, Wash.; Mrs. H. A. Helder, Canton, N. C.; Mrs. J. W. Hemphill, New York, N. Y.; Mrs. C. C. Heritage, Rumford, Maine; Mrs. H. Robert Heuer, Longview, Wash.; Mrs. W. S. Hodges, Portland, Ore.

Mrs. W. D. Jorres, Portland, Ore.

Dorothy J. Kelly, Longview, Wash.; Mrs. W. A. Kelly, Portland, Ore.; Mrs. C. J. Kern, Philadelphia, Pa.; Mrs. B. L. Kerns, Seattle, Wash.; Helen U. Kiely, Holyoke, Mass.; Mrs. L. Killam, Vancouver, B. C.; Mrs. G. M. Kirkpatrick, Longview, Wash.; Mrs. F. P. Klund, Portland, Ore.; Mrs. F. J. Kranhold, Neenah, Wis.

Mrs. E. C. Lathrop, Camas, Wash.; Mrs. O. L. La Roux, Little Falls, Minn.; Mrs. N. A. Lewthwaite, Port Townsend, Wash.; Mrs. J. G. Long, Camas, Wash.; Mrs. A. H. Lundberg, Seattle, Wash.

Mrs. Walter McBain, Camas, Wash.; Mrs. John McDonald, New York, N. Y.; Mrs. Ned Menzies, Cleveland, Ohio; Mrs. A. W. Miller, Cornell, Wis.; Mrs. C. W. Morden, Portland, Ore.; Mrs. H. R. Murdock, Canton, N. C.

Mrs. A. G. Natwick, Camas, Wash.; Mrs. R. S. Painter, Portland, Ore.; Mrs. L. L. Petrie, Portland, Ore.

Mrs. A. S. Quinn, Seattle, Wash.

Mrs. James G. Ramsey, Lowell, Wash.; Mrs. J. H. Richmond, Brooklyn, N. Y.; Mrs. Carl F. Richter, Watertown, N. Y.

Mrs. S. A. Salmonson, Camas, Wash.; Mrs. R. J. Schadt, Camas, Wash.; Mrs. R. W. Schneider, Chicago, Ill.; Mrs. H. C. Schwalbe, Philadelphia, Pa.; Mrs. Harlan Scott, Seattle, Wash.; Mrs. Ralph Shaffer, Tacoma, Wash.; Mrs. F. C. Shaneman, Tacoma, Wash.; Mrs. D. L. Shirley, Portland, Ore.; Mrs. A. B. Siebers, Longview, Wash.; Mrs. L. E. Smith, Port Edwards, Wis.; Mrs. J. L. Somerville, Tasmania, Australasia; Mrs. C. F. Stevey, Camas, Wash.; Mrs. E. Sutermeister, Cumberland Mills, Me.; Mrs. Walter H. Swanson, Neenah, Wis.

Mrs. Earl G. Thompson, Seattle, Wash.

Mrs. A. M. Van Douser, Rothschild, Wis.; Mrs. A. S. Viger, Shelton, Wash.

Mrs. T. J. Waltmon, Portland, Ore.; Mrs. R. L. Weldon, Larchmont, N. Y.; Nell C. Wiell, Portland, Ore.

Mrs. A. Zimmerman, Longview, Wash.

Swedish Pulp Sales Heavy

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., September 19, 1934—The Swedish wood pulp market is reported to have been quiet during August. Advance sales have been rather heavy, and only comparatively small quantities remain available for 1935 delivery. Prices are holding firm, reports to the Department of Commerce state. Some fairly large contracts for strong sulphite for 1935 delivery are reported to have been concluded with Continental buyers.

Fall River Paper Co. in New Home

FALL RIVER, Mass., September 14, 1934.—The Fall River Paper and Supply Company's new home at 96 Fourteenth street, is one of the most modern of its type here.

The new structure is twice as large as its predecessor, which was destroyed in the Merchants mill fire of January last, and is equipped with up-to-date appliances and conveniences which will increase the efficiency of the company's service to its large clientele.

The building is 96 feet by 85 feet and is three stories in height. The old building was two stories and 120x80. The 96 feet fronts on Fourteenth street and the 85 feet on Merchant street.

The exterior is of tapestry brick, trimmed with cast stone. Samuel B. Dubitsky was architect and James R. Thornley general contractor.

The shipping and receiving departments and the office are on the main floor and warehouses are located on the second and third floors.

There is a freight elevator to all three floors, garage space for the company's three trucks, a three-truck loading platform and the building is equipped with a sprinkler system.

In discussing the structure Morris Horvitz, Sr., proprietor, said: "We are naturally proud of our new building. It is well constructed and fireproof and a credit to the architect. We look for many more fruitful years of service to our patrons in our new home."

During the construction of its new quarters the company carried on its business at Front and Wordell streets.

Rainier Co. Makes Good Report

SAN FRANCISCO, Cal., September 12, 1934.—The Rainier Pulp and Paper Company, Shelton, Wash., for the fiscal year ended April 30, last, recently reported net profits of $458,460 after charges and taxes, equal to $4.58 a share on 100,000 shares of Class A $2 dividend cumulative stock on which the arrearage amounted to $683,333, or $6.83 a share at April 30, last. In the preceding fiscal year, net profits were $147,032, equal to $1.47 a share on the Class A stock.

The company declared four dividends on the Class A stock, amounting to $4 a share, of which $2.50 is payable September 5 to stock of record August 31; 50 cents on December 1 to stock of record November 10; 50 cents on March 1, 1935, to stock of record February 9, 1935, and 50 cents on June 1, 1935, to stock of record May 10, 1935. This is the first payment since December 1, 1930, and clears up all dividend in arrears to December 1, 1932.

Urged to Attend Convention

A. W. Leslie, president of the National Paper Trade Association and chairman of the Code Authority of the Paper Distributing Trade, has sent out the following call to the Fall Convention of the National Paper Trade Association to be held in Chicago September 24-26:

"Come to the Chicago convention. I am assured by leaders of the Trade in all parts of the country that they consider the coming convention to be the most important in the history of the Trade.

"Never before have we had so many loyal and tireless volunteers working on Association and Code problems. These men very well know that the Trade must have perfect solidarity both for defense and offense.

"Every member of the Trade, whether Association member or not, is earnestly urged to attend the Chicago convention."

Progress In Wisconsin Paper Mill Improvements

Large Addition to Waxing Department of Menasha Products Co. Nears Completion—Machinery May Be Installed and Plant Placed Into Operation Late This Autumn—Addition Started for Oshkosh Corrugated Box Manufacturing Co.

[FROM OUR REGULAR CORRESPONDENT]

APPLETON, Wis., September 17, 1934—Practically all the exterior work has been completed on the large addition to the waxing department of the Menasha Products Company, Menasha, Wis., the carton subsidiary of the Marathon Paper Mills Company. Construction was started early this summer. The interior work will be rushed to completion so machinery may be installed and the plant placed in operation late this fall to take care of increased production. C. R. Meyer & Sons Company, of Oshkosh, Wis., has the general contract.

Expansion also is in progress at the Oshkosh Corrugated Box Manufacturing Company, Oshkosh, Wis. Work will be started at once on an addition 92 by 100 feet in size. It will be two stories in height, and of fireproof construction. Parts of two old buildings will be razed to make way for the enlargement. More floor space has been needed to take care of larger output, and the addition will mean an increase of 50 per cent in manufacturing space. The estimated cost is $25,000. The contract has been awarded to Fluor Bros. & Smith, of Oshkosh, Wis.

Patents Granted for Seamless Wires

Seamless wires developed and put on the market during last year by the Appleton Wire Works, Appleton, Wis., are now protected by patent. Formal notice has been received by the Company from the United States Patent office at Washington, D. C., that patents applied for in October, 1933, have now been granted.

The patent was issued to A. B. Weissenborn, president of the company, and William E. Buchanan, sales manager. Their invention is a method of seaming the wires together by means of a lacing wire winding between the ends, eliminating the hump caused by the former method of splicing. Two claims of originality and improvement were filed.

Commercial rights have been assigned to the Appleton Wire Works by the patentees, and a marked increase in sales has been noted since the paper mill field was informed of these improved wires.

Additions to Lawrence Faculty

Howard W. Morgan, formerly instructor in pulp and paper manufacturing at the New York State College of Forestry at Syracuse, N. Y., has been named successor to George H. McGregor at the Lawrence Institute of Paper Chemistry at Appleton, Wis. Mr. McGregor recently accepted a position on the research staff of Weyerhaeuser Timber Company, Longview, Wash. Mr. Morgan will serve as instructor in pulp and paper technology.

The new instructor received his master's degree from Syracuse University in 1927 after completing his dissertation on a study of "The Effect of Hydrogen Ion Concentration on the Hydration of Cellulose." He was at Syracuse during 1927 and 1928 as instructor in mill analysis and paper making. From 1929 to 1931, he was associated with the Oxford Paper Company at Rumford, Me. He was instructor at New York State College from 1932 up to the present. Mr. Morgan served on the Standards Committee of the Technical Association of the Pulp and Paper Industry in 1933, was a member of the Alkaline Pulping Committee, and served as chairman of the Pulp Testing Committee. Among the articles written by him for technical journals are: "Wood Evaluation" "Methods of Hydrating Pulp for Strength Testing," and "A Comparison of Several Methods for Processing Pulp Test Samples." He will begin his new duties at the Institute October 1.

Another addition to the Lawrence faculty is Dr. Herbert L. Davis, formerly professor of chemistry at Westminster College, New Wilmington, Pa. He is a specialist in physical and colloid chemistry, and will be assistant professor of chemistry, succeeding Dr. L. A. Youtz. Dr. Davis is a graduate of Dickinson College at Carlisle Pa., and received his Ph. D. degree at Cornell University.

News of the Industry

The will of the late Lewis M. Alexander, deceased president of the Nekoosa-Edwards Paper Company, Port Edwards, Wis., has been filed in probate court at St. Petersburg, Fla., where he maintained legal residence. He left personal property estimated at $150,000, and real estate valued at $8,000. He left $2,500 to Ernest Eichsteadt and $1,500 to Anton Carlson, both of Port Edwards, Wis. The remainder goes to Mr. Alexander's widow, and after her death to his son, John E. Alexander, manager of the company.

An estate of approximately $40,000 in personal property and $7,000 in real estate was left by Gavin W. Young, late president of the Edgewater Paper Company, Menasha, Wis. All of his corporate stock in the company was left in equal shares to his two sons, G. W. Young, Jr., and J. D. Young. The former was also left the homestead. A daughter, Mrs. Barbara Coyle, was left $10,000. Eight grandchildren were given a bequest in trust until they are 18 years of age $1,000 each. The remainder of his estate is to be divided equally between his three children.

Dr. Theobald Bentzen, who retired as chief chemist of the Whiting-Plover Paper Company, Stevens Point, Wis., last summer, has left for Copenhagen, Denmark, to spend a year with his son, Knud, who is in the magistrate's service there. Upon his return he expects to reside at Stevens Point and continue to pursue his hobbies as an artist and music critic. Dr. Bentzen is a native of Denmark. He received most of his education in Denmark, but received his doctor's degree in Russia, where he lived from 1898 to 1903. During the World War he was employed in a large paper mill in Osnabruck, Germany. He also has resided in Italy, France, Belgium and London. He came to the Whiting-Plover company in 1923 and was chief chemist until he retired. He is now 78 years old.

M. W. Phelps To Be Assistant Manager

VANCOUVER, B. C., September 14, 1934—Morris W. Phelps, has joined the staff of Pacific Mills Limited at Ocean Falls, B. C., in the capacity of assistant mill manager. Mr. Phelps is well known in the pulp and paper industry on the Pacific Coast and was for a number of years technical director of the Crown Williamette Paper Company's plant at Camas, Wash.

Chicago Paper Market Displays Improvement

Demand for Various Standard Grades of Fine Paper Expands—Book and Cover Papers Exhibit Stronger Undertone—Position of Kraft Wrapping Paper Section Practically Unchanged —Inquiries for Ground Wood Papers More Numerous

[FROM OUR REGULAR CORRESPONDENT]

CHICAGO, Ill., September 17, 1934—A series of meetings culminating in the Fall meeting of the National Paper Trade Association are occupying the attention of many paper executives in the Chicago area. Despite the constant press of business arising from these sessions fall merchandising campaigns are already under way and producing some fairly good results. Demand has not as yet given indication of any other belief than that the Fall upturn may be somewhat postponed owing to a combination of circumstances affecting all lines of business.

Specifically, fine papers were reported to have given a fairly good account of themselves during the week. Bonds and ledgers noted some improvement in demand while other grades reported some increase in inquiries. The kraft market was practically unchanged, although some specialties were in better demand. Books and covers were giving evidence of a slightly better tone. The ground wood representatives report no change although there are sufficient inquiries to give rise to the belief that once the market and its ramifications in relation to newsprint are settled, the improvement will be impressive. The waste paper dealers are operating under the Code, according to reports, and doing comparatively well, although some perplexity is noted in relation to mixed papers and folded news where the board mills are asking for a changed interpretation.

Association Activities

During the past week a series of meetings were held in the city at which trade practice problems were discussed. Attendance at each of these meetings was gratifying. Classification, Converting and Offset committees met at the Drake Hotel in Chicago on September 11. The Writing Paper Manufacturers Association's executive authority met at the Blackstone Hotel during the morning of the same day. On September 12 the Book Paper Manufacturers Association held a general meeting at the Drake Hotel during the forenoon while the Converting Committee (writing paper below #4 grade Sulphite bond) met at the same hotel during the afternoon. The Groundwood Paper Manufacturers Association held a general meeting at the Drake Hotel on September 12. On September 13 the Book Paper Manufacturers Association held a general meeting at the Drake Hotel after which executives at various sessions held during the week went on to New York for further meetings.

The Middle West Division of the Salesmen's Association of the Paper Industry is out with the concise details of the National Paper Trade golf outing to be held at the Flossmoor Country Club on Thursday, September 27, the final day of the NPTA sessions in Chicago. All of the association meetings will be over on the night of the 26th, leaving a clear track for the all day outing at which every member present is invited along with merchant customer guests. A luncheon and an evening dinner which is to be over—at least as far as prize presentations are concerned—by 8:30 p.m. so that out of town guests can get down town to various railroad stations: are feature events of the program. Prizes are to be presented for both morning and afternoon play and the Presidents Prize, the Howard Trophy and the SAPEYE golf trophy are up for competition, along with a long list of special prizes. This outing event, a feature of last year's session, is also a windup of the golf season for the Salesmen's association. The energetic salesmen are also planning some special discussions during the time of the NPTA meetings at the Stevens. All in all, it looks like a big week for this organization and its guests. Full particulars as to the location of Flossmoor and other details may be secured from R. R. Cook, International Paper Company, golf chairman.

News of the Trade

"More Power to You-With Atlantic Bond" is the title of Eastern Manufacturing Company's latest direct mail piece which features an unusual fold and a quite out of the ordinary presentation of sixteen features offered by Atlantic Bond. "Each of the features of Atlantic Bond is geared to a definite requirement of the producer and user of letterheads and business forms," says the headline copy. A sample swatch of thirteen Atlantic Bond Colors is given prominent position. The LaSalle Paper Company is the Chicago distributor for Eastern products.

Four distinct folders, descriptive of Swigart Paper Company products, found their way into Chicago buying offices this week. The folders discuss Sulgrave Book, a "white-wove bulky antique"; Sulgrave Plate Finish; Signagraph Memeo and Sulgrave Laid Antique. The Sulgrave products are manufactured by the Standard Paper Manufacturing Company, of Richmond, Va. Each booklet gives a complete account of the product, price list, color swatches and full description of weights and sizes.

The J. W. Butler Paper Company and the Bermingham & Prosser Company are circulating a four page folder advertising Modern Form paper, manufactured by the Consolidated Water Power and Paper Company, of Wisconsin Rapids, Wis. The action of these two well known Chicago paper merchants in getting out this circular and thoroughly covering the Chicago territory has been followed by merchants in Newark, Philadelphia, Baltimore, Washington, Cincinnati, Columbus, Detroit, Grand Rapids, Indianapolis, Milwaukee, Kansas City, Omaha, Denver, Los Angeles, San Francisco, and other places, doing the same, so that this Chicago circular is having quite a widespread influence.

Pulpwood for Port Royal Co.

[FROM OUR REGULAR CORRESPONDENT]

TORONTO, Ont., September 17, 1934.—Port Royal Pulp and Paper Company, of Fairville, N. B., formerly the Nashwaak Pulp and Paper Company, reports a satisfactory current volume of business, with fairly substantial shipments to Canadian and American points. At present the company is engaged in getting down its winter supply of pulpwood. The company expects to bring about 35,000 cords of wood down stream by the middle of next November. The wood is from the upper reaches of the St. John River, from Grand Falls district, most of it being New Brunswick wood and some from Maine.

Northern Paper Mills Enter English Market

Green Bay Organization to Operate Under British Charter as Northern Tissue Co.—Evidence of Trade Revival In Great Britain Affords Opportunity for Sale of Company's Light Weight Papers—Canadian Charter Already Secured

[FROM OUR REGULAR CORRESPONDENT]

TORONTO, Ont., September 17—A representative of the Northern Paper Mills, of Green Bay, Wis., was in Toronto a few days ago having just returned from England where he opened the British market to the firms products. The firm has distributing warehouses in Toronto, as well as a processing plant for the handling of tissues and toilets. The Green Bay company will operate in the British Isles under British incorporation as the Northern Tissue Company, Canadian charter having been secured some time ago. The firm's representative has been spending some time in England studying the market there. He was favorably impressed with the outlook for business, there being evidence of a trade revival which made it opportune for the establishment of a branch in that country for the sale of the company's light weight papers. The company's processing plant is on Hanna Avenue, Toronto, and the general offices and distributing warehouse is on Gerarrd street.

Assessments Cut on Timber Lands

Lumber interests were granted long-sought relief this week when the Ontario Government passed an Order-in-Council materially reducing Government assessments on timber lands. The reduction, premised on the industry's agreeing to employ 10,000 men and applying to the sawmill trade as distinct from pulpwood production, was announced by the Premier after a conference with a large group of lumber and pulp men and members of the Cabinet. Secondary considerations to be exacted from the lumbermen by the Government include the provisions that the timber cut under the reductions shall be manufactured into finished lumber in Ontario. Welfare of the men working in the trade is protected by regulations calling for fair wages and the enforcement of the requirements of the Department of Health. The Minister of Lands and Forests is to be the arbiter of all problems that may arise.

May Refuse Aid to Newsprint

In the meantime there are rumors at Queen's Park that the Hepburn Government has no intention of coming to the aid of the newsprint operators in Ontario, and that, on the other hand, to increase departmental revenues from this source of industry, it may forbid the purchase of wood by the companies outside the province. Premier Hepburn made it quite clear again that the pulp and paper industry has yet to be completely surveyed by departmental officials, and intimated that it might be some time before the Government reached a decision as to policy regarding it.

Since the Government announced its intention to reduce bonuses and Crown dues in connection with the sawmill industry, as a means of providing more bush employment this year and stimulating sawmill operation generally, the view has been taken by newsprint operators that some similar line of aid for them would be shortly forthcoming.

Frederick Noad, former American lumberman, who is said to have assisted Attorney-General Roebuck in the preparation of all his anti-timber policy speeches of the last election campaign, and to have aided the Liberal Opposition during the last legislature in the drafting of order paper queries concerning lands and forests administration, has been authorized by the Government to make the newsprint situation survey.

Paper Box Makers Play Golf

A challenge game of golf between the paper box manufacturers of Toronto and those from Western Ontario was played at the Lake View Golf and Country Club, Toronto, this week, with 24 players on the course. The low gross score was chalked up by J. W. Hewitt, of Paper Sales, Ltd., Toronto; with F. Ogle, of Hinde & Dauch Company, Toronto, winning the net. Other prize winners were Charles Taylor, of Alliance Paper Mills; W. McIntyre, of Gummed Papers, Ltd., Brantford, and H. Hall, of the A. D. Shoupe Company, Toronto. There were twelve entries in the barnyard golf contest, J. A. Northey and Ira Good, of Toronto, winning the top scores. Other prize winners in this event were E. Collett, of Collett & Sproule, and D. Brown, of J. L. Morrison Company. Forty-four members of the paper box trade and allied industries sat down at dinner following the game.

Trenton to Be Pulp Port

[FROM OUR REGULAR CORRESPONDENT]

TRENTON, N. J., September 14, 1934.—City Commissioner Bernard J. Walsh has just announced receipt of advices from the Executive Authority, Pulp Division, of the Paper and Pulp Industry, that Trenton has been recognized as a port by that body for the imporation of wood pulp and paper.

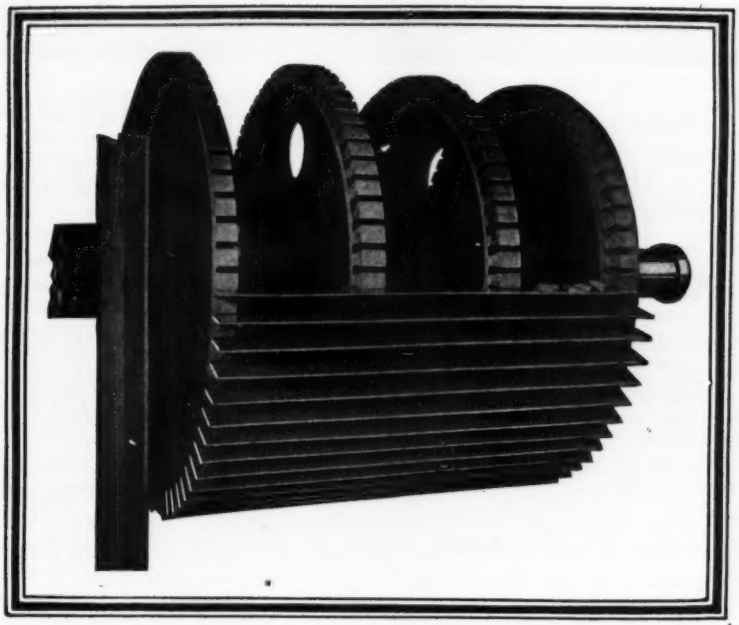
The action of the pulp industry authority culminates Commissioner Walsh's efforts over a period of more than a year and a half to have Trenton recognized as a port of that industry. In normal times, the consumption of woodpulp in the district that can be served on a preferential basis from the Port of Trenton amounts to approximately 40,000 tons annually. Present importations amount to approximately 27,000 tons. The action of the Pulp Authority is not to be interpreted as meaning that the entire volume of pulp tonnage will immediately be diverted to the Port of Trenton but will commence with the importation of small lots and increase gradually. However it may take two or three years before the industry completely reestablishes its set-up sufficiently to direct all the tonnage to Trenton.

Commissioner Walsh stated that this is another definite factor for the Port of Trenton that will add to the slow but sure increase in permanent tonnage commitments for this district.

The action of the Executive Authority is subject to ratification by the Association of American Woodpulp Importers and the Canadian Paper and Pulp Association and it is anticipated that such ratification will be forthcoming in a few days.

The first consignment of woodpulp for the Port of Trenton will arrive on either the S. S. "Hanley" or the S. S. "Hegira" during the month of September.

September—



Good beater rolls are absolutely necessary in stock preparation. You should use Dilts patented bandless all-steel rolls in both your breaker beaters and your finishing beaters. More than one thousand Dilts bandless rolls are in use in paper mills on practically every grade of stock.

—Dilts—

MACHINE WORKS Inc. FULTON, N.Y.

"Your Paper Is Made in Your Beaters"

Canadian Newsprint Export Association's Work

Organization May Sooner or Later Bring Various Newsprint Interests Closer Together for Advancement of Best Interests of Industry—Price Situation Aggravated by Loss of Premium on U. S. Dollar and Discount on U. S. Funds

[FROM OUR REGULAR CORRESPONDENT]

MONTREAL, Que., September 17, 1934—The recent appointment of Charles A. M. Vining to the position of president of the Newsprint Export Association of Canada has no other significance, it is stated, than the fact that this places in the position a permanent executive who can devote more time and attention to the position than could the original president, L. G. Belnap, who, as president of Consolidated Paper Corporation, accepted the chairmanship of the association on its formation only on the understanding that a permanent appointment would be made as soon as possible.

Advancing Best Interests of Industry

Behind the association, however, lies the hope that it may sooner or later bring the various newsprint companies closer together for the advancement of the best interests of the industry. In this connection the question of the price of newsprint is causing a good deal of anxiety, and the question has been aggrevated by loss of the premium on the American dollar and more recently the discount on United States funds. This switch in the exchange situation has meant a difference of several dollars a ton to newsprint producers, as compared with 1932, the existing discount alone representing a loss of almost $1 a ton on the selling price.

Hopes for Better Prices from NRA Have Faded

Hopes that NRA developments in the United States would place prices on a better basis have faded away, though to the extent that they have stopped under-cutting of the existing schedule they have been helpful. In some quarters here it is stated that there has been like evidence that those operators who have been chiefly responsible for existing conditions in the industry are willing to co-operate with those who were working for the restoration of a reasonable price structure.

It is pointed out that, between 1930 and 1933, over a four-year period, a group of Canadian companies— production of which represented 75 to 80 percent of the total output in the Dominion—have suffered a contraction of $78,000,000 in working capital. This does not take into consideration the fact that interest on the bonds of the majority of these companies has been in default for two years or more, or that inadequate or no provision for depreciation has been made in many cases. This indicates an actual loss to those producers during the four-year period of $100,000,000 or more resulting from the unreasoning price cutting and "chiseling" which has been rampant in the newsprint field.

Chief Hope for Binding Agreement

The chief hope for a binding agreement being consummated between all of the Canadian newsprint producers in the matter of prices lies, it is pointed out, in the possibility that the present desperate straits in which the indusry now finds itself may force those operators who have been the chief offenders in the past to fall into line in an honest effort to establish and preserve a reasonable price level. Some quota agreement would probably be involved in such a development, due to the excess mill capacity existing in the industry, and it is pointed out that in this, the provinces, or failing them the federal government through its Marketing Act machinery, could be of assistance.

Market Extending for Rayon Pulp

The Restigouche Company is stated to be developing a market for rayon pulp in Japan. At present about 80 percent of the production from the company's mill represents rayon pulp, being sold under substantial contracts with British, U. S. and Canadian rayon producers.

The Restigouche mill has been operating at capacity all this year, and earnings are running well ahead of bond interest requirements. Some rayon pulp tonnage to United States textile mills is being lost at present due to the strike in that country, but this tonnage is being absorbed in other directions by contracts the company had on hand.

On August 1 last, the Restigouche Company inaugurated payments on interest coupons on its bonds, and, provided conditions in the rayon industry remain as at present, the outlook for maintenance of interest payments appears bright.

British Interest in Rayon Pulp

R. O. Sweezey, of Montreal, who has been investigating districts in Eastern Canada and on the Pacific Coast for British interests who plan the establishment of a mill for the manufacture of sulphite pulp, states that British rayon mills, which have been making important advances in recent months, are now dependent on the foreign market as a source of raw material, most of their pulp originating in the Scandinavian countries. He says that the mill operators would prefer to do business within the Empire if possible, and Canada is regarded as the logical field. The only doubt concerning the project is whether the mill should be on the Pacific coast or in eastern Canada, according to Mr. Sweezey.

Advantages and Disadvantages

There are both advantages and disadvantages in connection with British Columbia as a site for a sulphite mill. The advantage lies in the fact that British Columbia alone can offer tidewater facilities open twelve months of the year and cheap water transportation. The chief obstacle is the distance from the markets and the uncertainty as to whether a sufficient volume of sulphite pulpwood lies within convenient reach of tidewater.

Newsprint mills use a growing percentage of hemlock and other species in their manufacturing processes, but sulphite mills suitable for manufacturing rayon pulp would require a very high proportion of spruce, and of spruce there are now only limited stands close to the sea, and these are all pretty well controlled by established newsprint and pulp mills, notably Powell River Company, Pacific Mills and British Columbia Pulp and Paper Company. Cost of transporting pulpwood from interior points would probably be excessive.

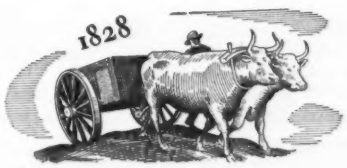
WE HELPED THEM TURN *from* SEARCHING *to* SELLING

(1) A manufacturer who had developed a new formula for a stock to be produced at less cost asked S & W to design and build a special wet machine which would overcome certain difficulties, allow his firm to meet the price requirements of a new market. The completed machine insured correct formation in the vats and a uniform sheet from the cheaper mix. It also cut the loss from drying oven wrinkles from 20% to less than 1%.

(2) Another manufacturer suffering great losses due to cutting uneven edges of paper asked S & W to develop a new calender feed. This device has reduced cutting losses from 25% to 1 or 2%, has enabled him to go after markets which before had considered his product too high-priced.

(3) A fine tissue and condenser paper manufacturer seeking to crack the quality market decided to make the finest possible sheet in widths of more than 100". No thickness variations, no pinholes, no waste from cockles would be allowed. Three special machines were designed and built by S & W—the widest Fourdriniers operating in the world today on finest tissue and condenser papers.

To you and your consulting engineer S & W *brings the country's longest experience in building machinery for high-grade papers. Send for* "CARRYING THE TORCH," *a brief history of American paper-making growth.*



"The CONSULTING ENGINEER *has a Part in the Picture"*

★

The SMITH & WINCHESTER *Manufacturing Company*

PLANT AND OFFICES AT SOUTH WINDHAM, CONNECTICUT

Philadelphia Paper Market Continues Quiet

Evidence of Expected Fall Revival of Demand for Various Standard Grades of Paper Still Lacking—Business Sentiment Among Local Paper Houses More Optimistic Over Future Outlook—Board Mill Request for Waste Paper Restricted

[FROM OUR REGULAR CORRESPONDENT]

PHILADELPHIA, Pa., September 17, 1934—With business in the paper industry as a whole here continuing to assume a strictly waiting attitude, evidences of widespread Fall revival are lacking. As reported in these columns last week the textile strike is conceded to be a dominant factor in preventing the regular seasonal stimulus which was anticipated by those in the trade. However, it was pleasing to note that business sentiment among many houses seems to have undergone a noticeable change for the better, although it is by no means a definite indication that uncertainty is non-existent.

A virtual quietus reigns in the waste paper market here. Mills were reported buying in limited volume. It is thought that any resumption of large-scale buying in mills will tend to stiffen prices among dealers and narrow the margin between buying and selling quotations.

Association Activities

Announcement from the headquarters of the Philadelphia Paper Trade Association in the Drexel Building is made of the appointment of Nathaniel Saxe, of the Saxe Paper Company, and W. B. Kilhour, Jr., of the Quaker City Paper Company, as delegates to represent the Coarse Paper Division of this association at the convention of the National Paper Trade Association to be held in Chicago September 24 to 26. Frederick S. Balch, secretary of the Philadelphia Paper Trade Association, was appointed in January by President T. H. B. Smythe to represent the Fine Paper Division, but on account of pressure of duties Mr. Balch requested that he be excused. Mr. Smythe suggested that Norbert A. Considine, vice president in charge of the Fine Paper Division, act as delegate in Mr. Balch's stead.

In a bulletin received at the association's headquarters, from the National Association, it states that the atmosphere about NRA is somewhat beclouded, and reports indicate the probability of considerable changes in organization and further possible changes in policies which may have a vital bearing upon the procedure of those charged with the administration of the Code. It further says that some clarification will probably take place before the Convention, and the Code Authority will endeavor to direct its course in the line of the announced or apparent policies of the Administration. But that in order to do this they must have the guidance and support of the trade, without which they cannot hope to function with any degree of success.

Bills for assessment for code operation, based on business of 1933 and the number of employees, were received here today by the trade, and to quote one of the outstanding paper merchants, he had to look twice at his. A notice was also received to the effect that the budget of the Regional Code Authority as approved by the National Code Authority, becomes mandatory.

At the first Fall meeting of the Paper and Cordage Association of Philadelphia, to be held in Adelphia Hotel the latter part of this week, William Carroll will be guest speaker. His subject will be "My Conception of Personal Service." On this occasion there will be presented to T. L. Richards, of the Buffalo Envelope Company, 401 North Broad street, a gold medal as an award for having won the golf trophy four times. The original award was a cup, donated by The Schuylkill Paper Company, and Mr. Richards having won it three times, on the occasion of his winning the fourth time, decided to turn it back to the association. Hence the presentation of the gold medal, with suitable inscription on it, to Mr. Richards, which will be made by Leslie C. Bartlett, chairman of the Entertainment Committee of the Association.

Norbert A. Considine, president of the Paper House of Pennsylvania, and William H. Kilhour, Jr., representing the Paper Trade Association of Philadelphia, have just returned from Washington, where they attended a meeting on the question of continuance of replacement costs as set forth in section 4, article 8 of the Code, and which has to do with sales below replacement cost. This would have expired as of October of this year. Application was made to have it continued until January 31.

News of the Trade

Mrs. Wilcox, wife of William S. Wilcox, of Wilcox-Walter-Furlong Company, has just returned much improved in health from a six weeks' tour of England, Sweden and Denmark.

Norbert A. Considine spent a few days visiting Crane & Co., at Dalton, Massachusetts, conferring with various officials regarding the details of their entire line, the agency for which has recently been announced by the Paper House of Pennsylvania.

Charles McDowell, of McDowell Paper Mills, Manayunk, is back in the city after a couple weeks' trip in his yacht *Charmarie*. Mr. McDowell cruised along the coast of Maine, visiting Bar Harbor, Watch Hills, and looked in on the races at Newport.

Myer Magil, treasurer and president of the Penn Card and Paper Company, and Mrs. Magil, are on a motor trip in New York State, which will include Niagara Falls. They will also visit their son, Rabbi R. J. Magil, of Beth El Tempel, Buffalo, N. Y., and his wife. They expect to return to Philadelphia about September 22.

Now Parker Paper Co.

On July 1 the twenty-seven-year old business of the Parker Paper and Twine Company, High Point, N. C., was acquired by the newly formed Parker Paper Company, A. B. Henley, president, W. I. Spaugh, vice president and W. C. Thompson, secretary and treasurer.

The new company will continue operation of their specialty bag factory, the capacity of which has recently been increased. They will also continue the jobbing of all kinds of coarse papers, twines and cordage and expect to add certain new lines as fast as proper connections can be made.

The officers of the Parker Paper Company are all men of many years experience in the paper and twine business and have every reason to expect the new business to enjoy a long and useful life.

SINCE 1866

Since 1866, the task of harnessing horsepower has changed. The story of this vast change is, to a large degree, the story of Socony-Vacuum Lubricants. From our original harness oil in 1866 and the first petroleum cylinder oil a few years later, to the complete list of lubricants now comprising the Socony-Vacuum line, we have played a leading part in Industry's progress. Some of this story is told in the following pages . . . more of it is being written daily within Industry itself.

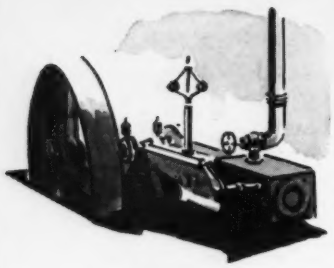
GARGOYLE

Lubricants

MILESTONES A

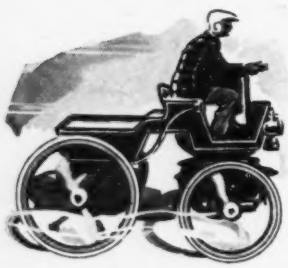
SOCONY-VACUUM CONTRIBUTIONS TO

1876—600-W FOR STEAM ENGINES



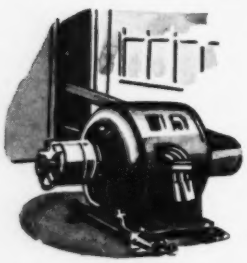
The first widely known Gargoyle Oil was 600-W for stationary steam engine cylinders. It actually made possible many improvements in steam engine design. Today more steam cylinders are lubricated with it than with any other cylinder oil. The largest steam engine in the world—25,000 h.p.—is Gargoyle Lubricated.

1877—OIL FOR MR. SELDEN'S AUTO



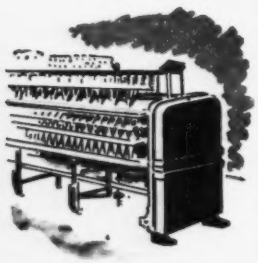
Mr. Selden's internal combustion automobile engine brought an acute problem in lubrication. In the words of George B. Selden, the inventor—"It is beyond doubt that the Vacuum Oil Company was the first to make a suitable mineral oil that would lubricate an automobile." Today Gargoyle Mobiloils are in use to a greater extent than any other automobile oil.

1885—OILS FOR ELECTRIC SERVICE



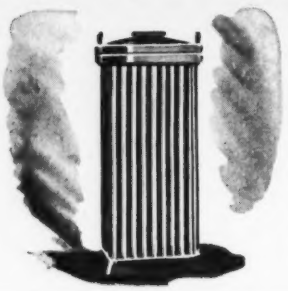
In the middle 80's new designs in electric generators and motors introduced the new speed of 1000 revolutions per minute. This brought a fresh lubricating problem. Gargoyle Lubricants were produced to meet this lubricating need. Today, in public utilities plants generating about half of all the current in this country, Socony-Vacuum Lubricants are used.

1889—OILS FOR HIGH SPEED SPINDLES



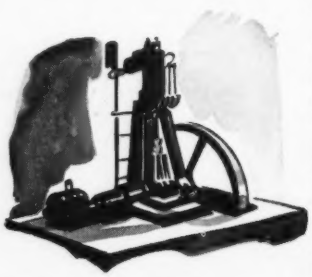
In the early eighties a relatively thin oil was used for spindle lubrication. Our engineers, however, believed that the oil was unnecessarily heavy for the work—resulting in an unnecessary waste of power. After a period of experimentation, Gargoyle Velocite Oils were produced. Textile mills reported a marked saving in coal bills—frequently as great as 40%—when Gargoyle Spindle Oils were used.

1891—OILS FOR TRANSFORMERS



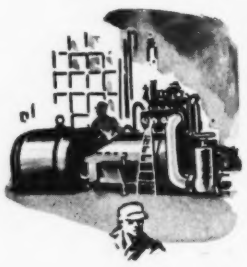
Early transformers stepped current up to 2000 or 3000 volts. The higher the voltage the greater the heat. Oil was the insulating and cooling medium. Working with electrical companies, our engineers produced distinctive grades of transformer oils specially adapted to their equipment. Manufacturers were enabled to raise voltages to ever higher figures.

1900—OILS FOR DR. DIESEL'S ENGINES



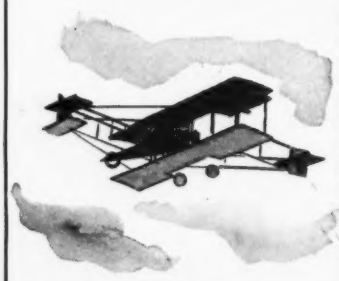
The Diesel Engine, with its high pressures and temperatures, again presented difficult lubrication problems. These were overcome by the direct cooperation of the makers of Gargoyle Lubricants with Dr. Rudolph Diesel. Today over 65% of Diesel driven ships use Gargoyle Lubricants, as do a large percentage of industrial Diesel users throughout the entire world.

1902—OILS FOR STEAM TURBINES



High speeds, high temperatures and the danger of oil systems choked with sludge, made the production of a satisfactory lubricant for steam turbines one of the most difficult problems that had been encountered in oil refining. Gargoyle D.T.E. Oils were developed to meet the situation. Today over one-half of the world's capital turbine units are running year in and year out with Gargoyle D.T.E. Oils.

1910—OILS FOR THE AIRPLANE

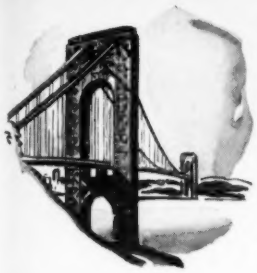


Gargoyle Lubricants came to the aid of the aviation pioneers with new lubricants. This fact was acknowledged by Mr. Glenn H. Curtiss, Mr. C. K. Hamilton, and by the Wright Brothers shortly after they made their pioneer flights in 1910. Today a long record of outstanding flights—Lindbergh's, Wiley Post's, for example—stand to the credit of Gargoyle Aero Mobiloil.

S ALONG THE WAY

NS TO THE EFFICIENT USE OF POWER

1927—OIL FOR THE WORLD'S LONGEST BRIDGE



In building the George Washington bridge, longest single span in the world, Gargoyle Lubricants were again used. The iron and steel industries, mines, smelters and rolling mills, machinery builders, automobile and truck makers, automobile accessory makers, in fact, leaders in all industries use Gargoyle products. They were also used in building the Empire State Building, the New York subways.

1934—OILS FOR AIR CONDITIONING

In the development of this newest engineering contribution to human comfort and welfare, air conditioning engineers naturally have looked to Socony-Vacuum for efficient lubricants, thoroughly dehydrated to withstand the low temperatures. Gargoyle Lubricants are now used exclusively by the world's largest maker of air conditioning equipment, and are likewise used 100% on the world's largest air conditioning installation.

1934—OIL FOR SHIPS OF THE SEVEN SEAS

Over 53% of the world's largest ships—those over 20,000 tons—use Gargoyle Marine Oils, as also do 65% of the world's Diesel driven ships—in fact, more than one-third of the merchant marine of the entire world. To meet this international preference for Gargoyle Lubricants, it is necessary to stock Gargoyle Marine Oils in 300 ports throughout the globe.

OILS FOR THE FOUR CORNERS OF THE EARTH

Gargoyle Lubricants are sold in 63 countries of the world. The foremost industrial plants in Europe use Gargoyle Lubricants for their exacting requirements. Of the several hundred largest industrials in the U. S. (not including oil companies) an overwhelming majority prefer and use Gargoyle Lubricants—as do mines and other users far from civilization.

TO MEET THE NEEDS OF TODAY!

GARGOYLE SUPER CYLINDER OIL 600-W

GARGOYLE D.T.E. OILS

GARGOYLE ARCTIC, VACTRA, VISCOLITE, and VELOCITE OILS

S-V TEXTILE OILS
S-V CUTTING AND SOLUBLE OILS

GARGOYLE
Lubricants

GARGOYLE GREASES

Out of the Mail—

A FEW UP-TO-DATE EXAMPLES OF SOCONY-VACUUM LUBRICATION AT WORK!

FROM PAPER MAKERS—

NO-LOAD POWER CONSUMPTION CUT 32.2%: A board mill in Ohio. With the competitive grease formerly in service, the power necessary to operate the entire machine under no-load conditions was 85.83 kw. With Gargoyle Lubricants, the power necessary to operate the machine was 58.23 kw. This is a saving of 27.6 kw. on a single machine and represents an overall saving in frictional power of 32.2%.

EMBOSSING MACHINES SPEEDED UP: In a Massachusetts plant, when three embossing machines were speeded up, it was impossible to maintain the increased production without excessive wear of the brasses and high maintenance cost. With the use of Gargoyle Lubricating Oils, applied as recommended, the troubles formerly experienced were eliminated and the increased rate of production was maintained with economy.

REPLACEMENTS OF CALENDER BEARINGS CUT 75%; RENEWALS ON EMBOSSING MACHINES CUT $100; TEMPERATURE RISE IN JORDAN BEARINGS 14° LESS: A Writing Paper Mill in Illinois. The use of Gargoyle Lubricating Oil on calender-stack bearings reduced the annual replacements from 12 bearings to 3. Following the use of Gargoyle Grease for the roller bearings of embossing machines, there have been no bearing failures, as compared with a replacement of 2 sets every year (at a total cost of $100) when a competitive lubricant was used. Gargoyle Lubricating Oil used on the thrust and plain bearings of a Black & Clawson Jordan also reduced the temperature 14 deg. F.

POWER CONSUMPTION REDUCED 13%: A southern mill making bag and kraft paper found, after using Gargoyle Lubricants for 4 months, that power consumption which formerly was 616 kw.h. per ton of paper has been cut to 536 kw.h. per ton, a reduction of 13%. This was one of the economies effected through operating correctly lubricated equipment.

BEATER BEARING TEMPERATURES REDUCED: Beater bearings in this plant formerly operated at temperatures ranging from 140 deg. F. to 210 deg. F. With Gargoyle Lubricants, the temperatures are now under 100 deg. F. —a saving in both power and maintenance.

SOCONY-VACUUM MARKETING POLICY

The controlled use of high quality Gargoyle Lubricants almost always pays for itself many times over. On equipment where the service does not justify lubricants of the highest grade, Socony-Vacuum engineers will recommend the lowest priced lubricants consistent with true economy. With a complete line of lubricants from which to choose, Socony-Vacuum can always supply the products best fitted for the individual job.

SOCONY-VACUUM OIL CO.

INCORPORATED

STANDARD OIL COMPANY OF NEW YORK • VACUUM OIL COMPANY • WADHAMS OIL COMPANY
WHITE STAR REFINING COMPANY • LUBRITE REFINING CORPORATION • WHITE EAGLE OIL CORPORATION
MAGNOLIA PETROLEUM COMPANY • GENERAL PETROLEUM CORPORATION OF CALIFORNIA

GARGOYLE Lubricants

Program For Paper Merchants Convention

The following is the preliminary program for the Fall Convention of the National Paper Trade Association to be held September 24-26 at the Stevens Hotel, Chicago, as issued by A. H. Chamberlain, executive secretary:

Monday Morning, September, 24

9:00 A. M.—Joint Survey Committee, R. M. Beckwith, Chairman.
9:00 A. M.—Gummer Tape Meeting, C. W. Andrews, Jr., Chairman.
9:00 A. M.—Manufacturers Contact Committee Fine Paper Division, O. F. Marquardt, Chairman.
9:30 A. M.—Wrapping Paper Meeting (Craft) L. S. Altholz, Chairman.
10:00 A. M.—Cover and Text Committee, W. W. White, Chairman.
Writing Paper Committee, P. A. Harris,
10:00 A. M.—Joint Meeting.
Chairman.
Code Authority Differentials
Conference Committee
Direct Selling Committee
11:30 A. M.—Tissue Meeting (Toilet and Towels)
F. B. Tracy, Chairman
11:30 A. M. Bristol, Blanks, Board and Tag Committee
J. P. Cunningham, Chairman.

Monday Afternoon

2:00 P. M.—Bag Meeting, J. S. Danehy, Chairman.
2:00 P. M.—Book Paper Committee, G. G. Cobean, Chairman.
3:00 P. M.—Offset Committee, A. M. Miller, Chairman.
3:00 P. M.—Ground Wood & Newsprint Committee, G. G. Cobean, Chairman.
4:00 P. M.—Blotting Committee, W. N. Gillett, Chairman.
4:00 P. M.—Envelope Committee, J. D. Swigart, Chairman.
4:00 P. M.—Specialties Committee, A. D. Riley, Chairman.
4:00 P. M.—Twine Meeting, G. W. T. Skinner, Chairman.

Monday Evening

7:30 P. M.—Executive Committee, Fine Paper Division, O. F. Marquardt, Chairman.
7:30 P. M.—Executive Committee, Wrapping Paper Division, H. L. Zellerbach, Chairman.
8:00 P. M.—Box Paper Meeting.
9:00 P. M.—Board of Directors, A. W. Leslie, Chairman.

Tuesday Morning, September 25

9:30 A. M. GENERAL MEETING.
Conducted by the Code Authority A. W. Leslie, Chairman.
Address: Frank H. Crockard, Deputy Administrator in charge of Wholesale Section, Division IV, NRA.
Report on Code procedure, present situation, outlook and future program.
Open Forum on the Code.
Questions and Answers.
Presentation of standardized Accounting Manual.

Tuesday Afternoon

2:30 P. M.—GENERAL MEETING
The National Paper Trade Association, President A. W. Leslie presiding.
President's Address.
Report of Board of Directors.
Report of Treasurer, Chas. Addoms.
Report of Executive Secretary, A. H. Chamberlain.
Address: W. W. Pickard, Co-ordinator of of the Paper Industry.
Discussion:
Province and functions of the Association. Plan of Organization. Membership. Financing. Working set-up. Program for the future. How can the Association capitalize on Code Activity in its organized efforts to improve the Paper merchandising business and promote the interest of the trade?

Tuesday Evening

6:30 P. M.—ROUND TABLE DINNER—Presidents and Secretaries of Local Associations.

Wednesday Morning, September 26

10:00 A. M.—WRAPPING PAPER DIVISION MEETING, Vice-President H. L. Zellerbach, presiding.
Presentation and discussion of Community
Committee reports and programs.
Manufacturers' trade customs, distribution practices and policies of sale. Resale schedules.
How to use the "Green Book".
Manufacturers operating as distributors.
The problem of wholesale grocers.
The problem of chain stores.

Wednesday Afternoon

2:30 P. M. FINE PAPER DIVISION MEETING, Vice-President. O. F. Marquardt presiding.
Reports and recommendations of committees.
Manufacturers' terms, trade customs and practices, and selling policies.
Manufacturers' service stocks.
Direct selling.
Job Lots and Seconds.

Czechoslovakia's Paper Industry

The improvement of Czechoslovakia's pulp and paper industry, noted earlier in the year, continued through the month of May. Wood pulp production remained at the same level as before (70 to 73 per cent of the industry's capacity). Prices remained steady. No strikes or lockouts occurred in the industry and supplies of raw materials were sufficient. While most of the country was suffering from unusually dry weather, certain sections in the eastern part of Ruthenia and Slovakia experienced heavy rainfall, causing several wood pulp mills to suspend operations. On the last trading day in May, pulpwood from Bohemian and Moravian forests, for export to Germany, was quoted on the Prague Lumber Exchange at 110 to 120 crowns per cubic meter f. o. b. Bohemian-Saxon frontier station. This price has been in effect since February, 1934.

Paper Distributors Urge Maintenance of Replacement Cost Principle Under Code

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., September 19, 1934—Spokesmen for the 1,649 firms engaged in the wholesale distribution of paper, appealed to the NRA last week for the maintenance of the replacement cost principle. Led by A. W. Leslie, Minneapolis, Minn., chairman of the Code Authority for the paper distributing trade, they appeared at a public hearing to support their application for an extension to January 31, 1935, of the order establishing wage allowances. The hearing was conducted by Deputy Administrator Orion Libert, assisted by Arthur H. Schroeder.

The code declares it an unfair trade practice to "sell any merchandise below replacement cost thereof to the seller," plus "an allowance for actual wages of labor." These provisions were to remain in effect until July 1, 1934, but were extended to October 1, 1934.

The allowances for actual wages of labor which are to be included in the selling prices established by the National Recovery Administrator on June 7, follow:

Fine Paper Division	Percentage for Labor Costs
(1) Warehouse sales	12 percent
(2) Indirect sales	3 percent
(3) Direct sales	2 percent
Wrapping Paper Division	**Percentage for Labor Costs**
(1) Warehouse sales	9 percent
(2) Indirect sales	2 percent
(3) Direct sales	1 percent

The distributors insisted today that it was desirable to have a full year's operation of the replacement cost provisions, in order that a permanent policy for the trade might be determined. The data for such determination, it was explained, could not be obtained until the closing of the members' books at the end of the year.

It was apparent, however, that Mr. Leslie and his associates were greatly concerned over the prospect that the trade might be faced with a refusal of the Administration to continue the mark-ups even beyond October 1.

Their position was assailed by representatives of the wholesale grocers, who contended that sales of paper bags, waxed paper, paper napkins, paper plates and other paper products sold generally by grocers, should be governed by the wholesale grocers trade and be subject only to the mark-up for that trade. This, they declared, was essential if grocery distributors were to continue in competition with paper distributors. Under their code, they asserted, a 9 percent mark-up is not justified.

The presentation of Mr. Leslie was supported by Norbert A. Consadine, of the Paper House of Pennsylvania, Philadelphia; W. B. Killhour, of the Quaker City Paper Company, Philadelphia, and Harold L. Zellerbach, San Francisco, Cal.

Mr. Consadine discussed the effect of the provisions on conditions in the "fine" paper trade. Mr. Killhour spoke of its effect on the wrapping paper trade. An analysis of distribution costs was given by Mr. Zellerbach.

Sales of paper distributors in 1929, Mr. Leslie said, amounted to $558,000,000. In 1933 they were $241,000,000. In 1933 the number of employes was 19,881, he said, and 56.5 percent of the gross margin received by the trade was paid to them. He reminded the deputy administrator that the Census of Distribution, in 1929, showed that in general wholesaling, salaries and wages totalled only 4.34 percent of sales, whereas in the paper business they totaled 11.65 percent.

Both Mr. Leslie and his associates credited the code with a marked improvement in the trade. Business had suffered greatly, they declared, from speculative buying and consequent stock surpluses, which had to be disposed of at any rates obtainable.

"The trade has been operating at a severe loss," Mr. Leslie said, "and it is manifest that it needs protection against uneconomic existing practices. To be of benefit to the trade, the code should eliminate as far as possible unsettling elements such as speculative wholesale buying. Wholesale speculation in commodities is too expansive a price to pay for rugged individualism. The speculative buyer can be controlled only by a law common to the trade which will permit him to dispose of his speculative purchases only on the competitive basis of replacement cost, plus his cost of distribution."

He declared the small merchant was particularly interested in the question, and that only by restricting sales below replacement cost could he be protected from annihilation. The buying power of the larger units, he added, gave them the "key" position in acquiring speculative stocks.

"Selling below replacement costs," he continued, "has been one of the worst evils of our trade. This injunction against sales below replacement cost is justly regarded as the crux of the trade's difficulties, and is the greatest improvement possible of attainment under the code."

He warned that without the replacement cost formula, the problems of securing compliance with the code provisions would become almost insurmountable. "The formula is fair to both the large and small buyer," he concluded, "and works no hardship on those members of the trade who do not have adequate financing for anticipatory buying."

Union Bag Confers with Employees

[FROM OUR REGULAR CORRESPONDENT]

HUDSON FALLS, N. Y., September 17, 1934—A conference between officials and employees of the Union Bag and Paper Corporation was held this week relative to new wage and working agreements but it was decided to await the signing of the revised Federal Code before taking any action. John P. Burke, president of the International Brotherhood of Pulp, Sulphite and Paper Mill Workers, declared that a feeling of good will exists between both officials and employees and no trouble is anticipated. Among those representing the company at the conference were Alexander Calder and John T. Gamble, president and general manager respectively. Matthew Burns, president of the International Brotherhood of Papermakers, and John P. Burke represented the workers. It was stated that an increase in wages is sought as it is claimed that workers in competitive mills performing the same class of work are receiving a higher rate.

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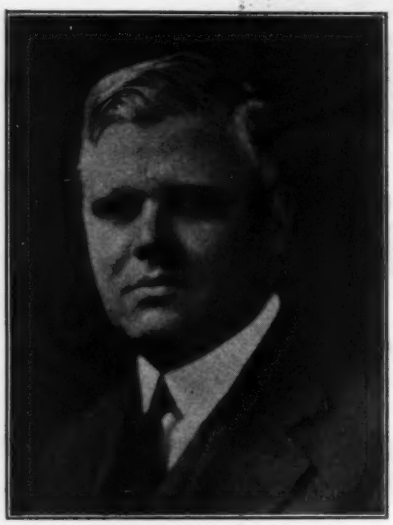
George Akerson Elected Executive Secretary of the Paper Trade Code Authority

At a meeting of the Code Authority of the Paper Distributing Trade held in New York on September 10 and 11, a program of expansion and increased activity was adopted.

A. W. Leslie, chairman, announced the appointment of George Akerson as executive secretary of the Code Authority.

Mr. Akerson was formerly secretary to President Hoover at the White House from 1929 to 1931. Before that time he had served as personal assistant to the Secretary of Commerce for three years. Upon graduation from Harvard University in 1912, Mr. Akerson entered



GEORGE AKERSON

newspaper work and continued in that profession until he went into the Department of Commerce with Mr. Hoover. In this Department he came into close contact with the organization of business groups. Last week President Roosevelt appointed Mr. Akerson as a member of the U. S. Board of Veterans Appeals, a position which he declined in order to take up the work in the Paper Distributing Trade.

In announcing the appointment of the executive secretary, Mr. Leslie, the Chairman, said: "We believe that it is necessary at this time to enlarge the work of the Code Authority. We have every confidence in the benefits and permanence of the Code organization.

"At our meeting on September 11, George Akerson was named as executive secretary. He will devote his entire time to Code Administration and the vigorous direction of national and regional activities.

"The growing volume of work in the executive office has been greater than the over-worked staff could efficiently handle. A further increase must be provided for. Although a splendid foundation has been laid and much has been accomplished, the Code Authority believes that the real benefits of the Code are yet to be realized. It now undertakes a broader education of the trade as to the provisions of the Code and the advantages to be gained through operating under them. It will appeal for observance in letter and spirit as an expression of the ethical principles and the enlightened self-interest of the industry.

"In these policies and efforts, the Code Authority will have the wholehearted cooperation of the National Paper Trade Association. These two agencies of the trade exist side by side, each with distinct functions but each supplementing the other and in many respects dedicated to a common purpose. The one, however, is an administrative body; the other is the recognized forum of the trade in the collective study of its problems which has provided a source of guidance and educational influence for over thirty years.

"A. H. Chamberlain, executive secretary of The National Paper Trade Association, who has been acting as secretary and treasurer of the Code Authority, will continue as treasurer and assistant secretary of the Code Authority. Assistant secretaries C. A. Spaulding and J. H. Londergan, valued members of The National Paper Trade Association staff, will also participate in carrying on the work of the Code Authority in their respective fields. With this enlarged staff and coordination of working forces, the leaders of the Paper Distributing Trade confidently look forward to the solution of many vexing problems and the establishment of sound practices and stabilized marketing conditions from which general and substantial benefits will accrue to the entire trade."

Better Prices Help Crown Willamette

[FROM OUR REGULAR CORRESPONDENT]

SAN FRANCISCO, Cal., September 12, 1934.—A moderate increase in sales, improvement in earnings of the company's Canadian subsidiary—Pacific Mills, Ltd.—and better prices for paper products other than newsprint brought about the substantial recovery in earnings of Crown Willamette Paper Company during the three months ended July 31. For the first time since 1931 profit in this quarter was sufficient to cover all preferred dividend requirements for the period and leave a small balance for the common stock.

Crown Willamette's earnings were not influenced to the same degree by the longshoremen and marine workers' strike on the Pacific Coast as were those of the other subsidiaries of the parent company, Crown Zellerbach Corporation. Currently there are signs of a moderate revival in the volume of business being done by these other subsidiaries which probably will be reflected in the report for the current quarter—the three months ending October 31.

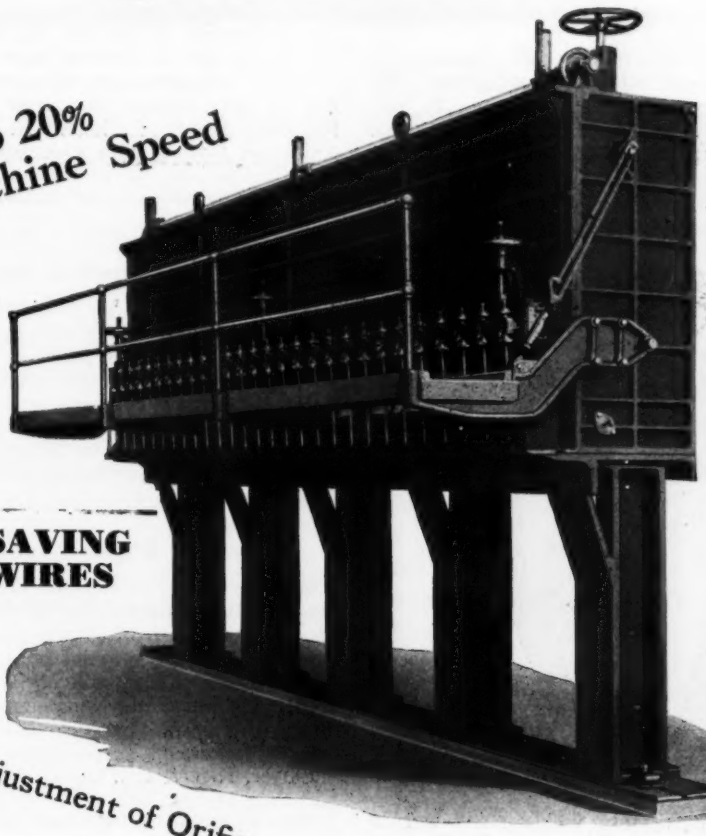
Consumption of all paper products, including newsprint during the first six months this year, ran considerably ahead of the like 1933 period, but there was a decided slump in demand and volume of sales on the Coast during the recent labor trouble. Normal operating conditions in the Coast paper industry were restored rapidly following termination of the transportation labor controversy in July.

Western Paper Co., New Brown Agent

The Western Paper Company of Fort Wayne, Ind., has been appointed an agent for Brown's Linen Ledger, the well-known permanent record paper made by the L. L. Brown Paper Company, Adams, Mass.

VALLEY-VOITH

High-Pressure Stock Inlet



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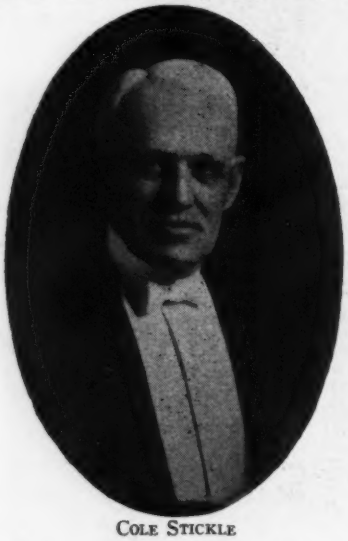
Obituary

Cole Stickle

INDIANAPOLIS, Ind., September 10, 1934.—Cole Stickle, of 2346 Central Avenue, Indianapolis, Ind., passed away August 29 at his home after an illness of several years duration. He was 77 years of age.

Mr. Stickle was born in Shaftsbury, Vt., January 20, 1857, the son of John B. and Minerva Cole Stickle. He was educated in the Public Schools at Shaftsbury, Vt. and the Manchester Seminary at Manchester, Vt. In his early life he was in the furniture and lumber manufacturing business in Vermont and later at Salem, N. Y.

In 1905 Mr. Stickle invented the Open Coil Heater and Purifier and came to Indianapolis to found the Stickle Company. Since that time Mr. Stickle has been granted



COLE STICKLE

numerous patents. Perhaps those which stand out in the paper industry are the Stickle Thermic Vacuum Traps, Stickle Automatic Steam Control, Stickle Differential Drainage System, and the Stickle Blast Coil Economizer,

Mr. Stickle was a member of the M. E. Church, Oriental Lodge F. & A. M., A. A. Scottish Rite and the Murat Temple of the Shrine.

Survivors are the widow and son, John B. Stickle, and a nephew, Fred A. Stickle.

Since the illness of Mr. Stickle the son has managed the business and will continue to do so as in the past. Burial was in Crown Hill Cemetery at Indianapolis.

Col. M. W. Renick

[FROM OUR REGULAR CORRESPONDENT]

DAYTON, Ohio, September 17, 1934—Colonel M. W. Renick, 75 years old, died at his home on South Main street, Middletown, Ohio, last Wednesday, after an illness of a week. For a number of years Colonel Renick was treasurer of the Advance Paper and Bag Company, retiring from that position in 1924.

For the last half century, Colonel Renick had been identified prominently with the financial, industrial and civic life of Middletown, dating from the early nineties, when he came from Kentucky, married Miss Mae McCallay and became cashier of the First National Bank. He later was chosen president of this institution, a position he held until this bank and the Merchants Bank were merged into the First and Merchants Bank.

His activities in municipal life consisted of one term as city councilman in 1903 and 1904, and later as City Commissioner in 1920.

Colonel Renick was a charter member of the Queen City Club of Cincinnati and was first president of the former Butler County Country Club near Hamilton. He was a member of the Elk and Masonic Lodges, serving for the former as Exalted Ruler in 1898.

Colonel Renick's first wife died in 1916 and his sons, Robert and William, soon after. He married Mrs. Ella Ragsdale, sister of Charles R. Hook, president of the American Rolling Mill Company, several years later.

A number of the prominent paper manufacturers in the Miami Valley served as honorary pall-bearers at the funeral.

Frank D. Edwards

BINGHAMTON, N. Y., September 17, 1934—Frank D. Edwards, of 75 Grand Boulevard, vice president of Stephens & Co., wholesale paper merchants, died recently at his summer home at Heart Lake, Pa.

Mr. Edwards is survived by his widow, Adelia H. Edwards; a daughter, Mrs. Percy D. Turrell, of Binghamton; and four sisters, Mrs. Emma Priest, Mrs. Mary Flanders, Mrs. John May and Mrs. William Hart, all of Cortland.

Boston Paper Trade Happenings

BOSTON, Mass., September 17, 1934—In their September Blue Book, John Carter & Co., Inc., refer to September as "the month of promise," noting that the printing industry has always found improved business "after Labor Day!" This year will be no exception and many advertising and selling campaigns will be launched this month. The Blue Book contains attractive offerings in odd lots, over-runs, discontinued items and seconds.

Carter, Rice & Co., Corp., are distributing a broadside featuring Hyfect, one of the new Kimberly-Clark papers. It calls attention and demonstrates certain basic qualities of this grade—its smooth surface, allowing the proper ink absorption requisite for good smooth solids; its strength and opacity, and also the fact that there is no apparent difference in color or surface on both sides of the sheet.

George MacDonald, chief clerk in the Boston office of the Brown Company, has been enjoying a week's vacation touring through Washington, D. C., and the South.

Charles J. O'Brien, salesman for the Baird & Bartlett Company, left this week for a vacation which will include Detroit and probably the Century of Progress Exposition at Chicago, accompanied by Mrs. O'Brien.

Crane Promotes Mork

On September 1 Crane Company announced the transfer of P. R. Mork from New York to the general office in Chicago where he will serve as vice president in charge of sales. Mr. Mork, who was vice president in charge of the New York territory, enjoys a wide acquaintance throughout the industry having served as manager of the Minneapolis and Duluth branches before going to New York in 1927. In his new position he will assume the duties of vice president H. W. Seymour, who is on leave of absence due to ill health.

P. R. Berryman, formerly vice president of the Trenton Potteries, has succeeded Mr. Mork as manager of the New York branch and associate branches of Crane Company in the metropolitan area.

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Waste, inefficiency and lost motion have no place in today's industrial scheme. The up-to-date replaces the obsolete. Permanence of new-equipment performance—without excessive maintenance or renewal costs—is obviously an item of importance. Correct applications of industrial chromium plate frequently offer the surest guarantee of long equipment life and maintained quality production.

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Applications of industrial chromium plate are as varied as the need for protection against wear and corrosion. Chromium is the hardest commercial metal; remarkably smooth and frictionless; completely corrosion-resistant and unaffected by most acids or chemicals. The protection afforded by CRODON plate needs no elaboration. The combination of these factors results in equipment of rare endurance and pronounced excellence.

Permanent accuracy of precision equipment is assured with CRODON plate. The most exacting tolerances can be met and *maintained*. Expensive hardening processes and costly alloys may often be replaced by chromium plate with equal benefits and at lower cost.

The resources, experience and reputation of America's largest and oldest industrial chromium plating organization are behind every CRODON application. The ability to successfully apply industrial chromium plate in such a way as to produce the desired results with the minimum of expense is the result of wide experience and careful attention to each customer's particular requirements. Our long and varied experience assures you a profitable service return on your investment. In most applications CRODON plating pays for itself in a few months' operation—trouble-free performance continues thereafter to return substantial dividends.

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Consider where chromium plate might apply in your operations—you will benefit by using it. Specify CRODON plate for built-in assured performance. It offers, at low cost, an economical and dependable solution to problems of combating wear and corrosion.

Bring these problems to chromium headquarters—our representatives will be glad to advise how CRODON can be economically and profitably applied to your particular requirements.

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August Newsprint Production

Production of newsprint in Canada during August, 1934 amounted to 216,164 tons and shipments to 209,938 tons according to the News Print Service Bureau. Production in the United States was 80,903 tons and shipments 90,482 tons, making a total United States and Canadian news print production of 297,067 tons and shipments of 300,420 tons. During August 30,223 tons of news print were made in Newfoundland and 1,868 tons in Mexico, so that the total North American production for the month amounted to 329,158 tons.

The Canadian mills produced 415,522 tons more in the first eight months of 1934 than in the first eight months of 1933, which was an increase of 33 per cent. The output in the United States was 25,743 tons of 4 per cent more than for the first eight months of 1933, in Newfoundland 43,311 tons or 26 percent more, and in Mexico 2,152 tons more, making a net increase of 486,728 tons, or 23.4 per cent.

Stocks of newsprint paper at Canadian mills are reported at 61,359 tons at the end of August and at United States mills 20,601 tons, making a combined total of 81,960 tons compared with 85,313 tons on July 31, 1934.

An Interesting Plykrome Installation

Notable among the numerous installations of Plykrome made during the past year is that in the Milwaukee Sewage Disposal Plant, where this new stainless clad steel is being fabricated into an 1800 foot line of pipe ranging from two feet to five feet in diameter.

Plykrome, a unique stainless clad steel, produced exclusively by Illinois Steel Company, has been widely adopted for corrosion resisting installations, but this is the first instance in which it has been used to reduce the friction of compressed air passing through a pipe. It was found, in the preliminary engineering studies for the new sewage plant, that an air duct of cast iron would have to be several inches larger in diameter in order to carry the necessary volume of air. This, in turn, would have necessitated expensive alterations in the buildings.

It was desirable to use a metal which had a low internal coefficient of friction, and which, further would not be subject to corrosion and hence to a gradual accumulation of scale, rust, or dirt which would tend to increase friction through years of operation. Plykrome met all requirements. It could be readily fabricated with its stainless surface on the interior of the pipe, where it would effectively resist corrosion for an indefinite period.

FIG. 1

One of the 54-foot sections of pipe for the Milwaukee Sewage Disposal Plant, fabricated entirely from Plykrome, supplied by Illinois Steel Company. Plykrome, a stainless clad steel, was adopted for this important installation to assure low internal friction for a compressed air duct.

FIG. 2

Forming one of the Plykrome plates in the plant of the Cream City Boiler Co., Milwaukee, fabricators of this interesting installation. The completed pipe will be 1800 feet long with diameters varying between 2 feet and 5 feet. Arc welding was used in fabricating the 315,000 pounds of ¼ inch Plykrome required.

The fabrication of the Plykrome has been in the hands of the Cream City Boiler Company of Milwaukee. Arc welding has been used for fabrication as well as for the field welding involved in the installation of the duct. The Plykrome used is one-quarter inch thick with an inside stainless veneer of USS 18-8 Stainless Steel. The pipe has been fabricated in sections of approximately 54 feet in length. Each section is made of nine plates of Plykrome. Each plate is formed and placed in a special welding clamp for making the longitudinal seam—a plain butt weld made with 18-8 stainless steel electrodes on the inside and with heavily coated mild steel electrodes for the outside. A welding speed of approximately 50 feet per hour has been maintained.

Nine of the plate shells thus formed are welded together to make the 54-foot sections of pipe. The circumferential joints are butt welds made after the plates had been sheared square and placed with a 3/32 inch gap between edges.

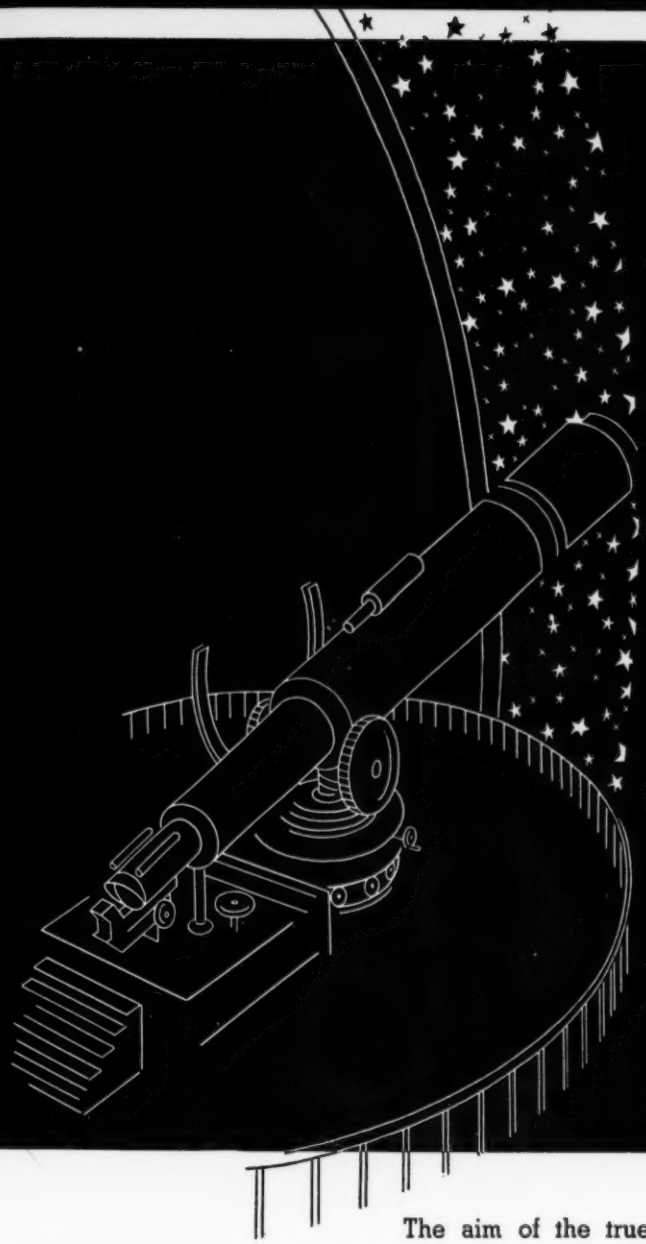
About 1325 feet of the pipe is 5 feet in diameter. The balance ranges from 24 inches to 48 inches.

The entire project requires approximately 315,000 pounds of Plykrome—the largest single installation of stainless clad steel ever made. The completion of the installation is scheduled for December 1.

Swedish and Finnish Markets Quiet

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., September 19, 1934—The usual summer dullness is still under way in the Swedish and Finnish paper markets reports reaching here state. The newsprint market is fairly brisk for this time of year. Mills are well sold out for the current year, the reports say, and some contracts have been entered for 1935 delivery. Buyers are taking their deliveries very promptly and new orders for quick shipment are also reported. Consumption in the United Kingdom and the United States, the two leading markets, seems to be improving. The demand for wrappings and fine papers continues dull.



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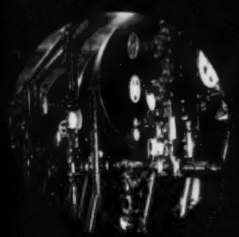

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Make Good Paper

APPLETON WOOLEN MILLS
Appleton, Wisconsin

Boston Paper Market Conditions

[FROM OUR REGULAR CORRESPONDENT]

BOSTON, Mass., September 17, 1934—The slightly better paper market which recently developed was sustained during the last week, at least in certain quarters, although some houses do not see much improvement yet. Firms selling to textile mills which are not now operating on account of the strike note a decrease in the volume of orders. Business among fine paper houses was somewhat stimulated by the abundance of fall announcements from various firms in other industries. What is of particular interest is the fact that some of the advertisers looked for distinctive grades of paper, rather better than they have been using. For instance, some women's apparel shops desired a fairly high grade of paper. Wrapping paper continued moderately better. Box board prices held up well, but only a moderate volume of business was transacted.

In paper stock, old newspapers moved rather well, but the value did not advance above the minimum Government controlled price. Mixed papers sold in rather small amounts, with the listed price not showing any advance above the Government level. Some manufacturers purchasing these low grade waste papers do not seem to be taking the Code prices very seriously, according to reports in the trade, as there seems to be a way of beating the Code values at the expense of a number of dealers. Outside of the activity in old newspapers and mixed papers, the paper stock market is reported as very quiet. If the textile strike is prolonged, some waste is expected to sell at higher prices, such as certain grades of bagging, as previously intimated in these columns. During the week, however, the price of foreign manila rope declined to 1.75 from 1.90 @ 2.00 and that of domestic manila rope to 1.90 @ 2.00 from 2.00 @ 2.20. New and old domestic rags moved very slowly. Under old domestic rags, the price of No. 1 roofing stock declined to .70 @ .75 from .80 @ .85, a quotation which has prevailed for some time. In foreign rags there was little or no business.

Firms and mill representatives selling twine to textile manufacturing concerns have had a diminished demand since the labor trouble began.

Mathers-Lamm Have Silver Anniversary

The Mathers-Lamm Paper Company celebrated its silver anniversary at a lawn party, unique in its simplicity at 3501 36th street N. W. on June 16 on the spacious lawns of the estate of R. E. Mathers, President of Mathers-Lamm Paper Company.

The party was well represented by both official and business representatives.

The lawns were tastefully decorated by myriads of colored lanterns, together with festooned lights playing on the two fountains made a lovely scene.

R. E. Mathers made quite an appropriate address welcome to the guests and employees assembled, in which Charles W. Lippold, chairman of arrangements, responded in behalf of the rank and file of office force. All the employees made very responsive addresses which were very gratifying to Mr. Mathers. The general trend were for his continued success and health. Mr. Lieppold presented him in behalf of the employees with a lovely silver headed umbrella, suitably engraved 1909-1934.

Games were played and enjoyed by all. Buffet supper was served and musical entertainment conducted by W. G. Ward who has been salesman for the company for a period of over 20 years.

To Be Manager of San Francisco Div.

Announcement has just been made by James K. Moffitt, president of Blake, Moffitt & Towne, that the board of directors has appointed Arthur W. Towne manager of the San Francisco division, the parent house of the large coastwide chain of paper merchants. Established in San Francisco in 1855, the company is a true pioneer in the wholesaling trade, and Arthur W. Towne is a representative of the third generation in its active management, his grandfather, J. W. Towne, having been associated with James Moffitt and Francis Blake, the founders, and his father, A. G. Towne, having served as head of the company prior to his retirement from business and death, several years ago. His brother, James W. Towne, is first vice president of the corporation.

Arthur Towne's experience in the paper business began shortly after his graduation from the University of California in 1916. With the entry of the United States into the world war, he attended the first officers training camp and was commissioned Second Lieutenant in the Coast Artillery Corps. Of his two years service in the army, six months were spent in France with the 67th Artillery, C. A. C.

After the war he re-entered the paper business, devoting his energies to the selling and advertising activities of the company. Always a believer in sound business cooperation, Mr. Towne has interested himself in the affairs of the National Paper Trade Association and the Pacific States Paper Trade Association. He served as president of the Pacific States body last year, presiding over the annual convention held last May at Del Monte, Cal., and as director of the National Association, represented the coast at the fall meeting at Chicago and the annual meeting held in New York in February. Code activities have also occupied much of his attention and during the organization period Mr. Towne acted as vice chairman of the Pacific States Regional Committee of the Paper Distributing Trade.

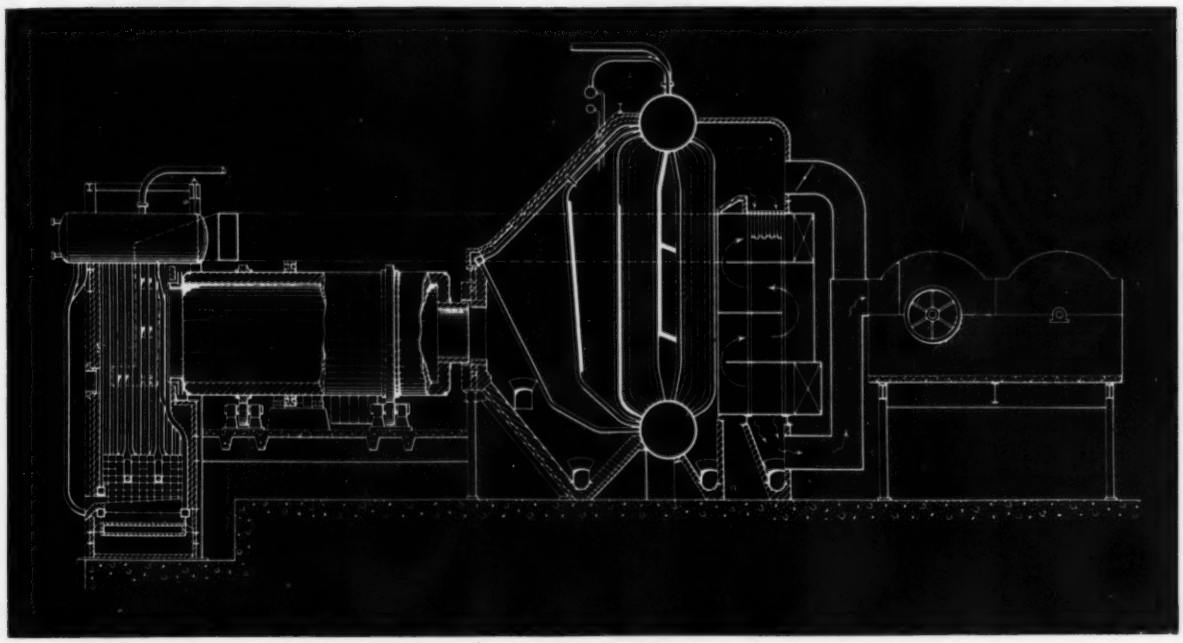
In commenting on the appointment of Mr. Towne as manager of the San Francisco division, O. W. Mielke, under whose direction as general manager the merchandising activities of the corporation center, emphasized Mr. Towne's experience and background in the paper business, pointing out that his qualifications include not only a valuable knowledge of the business, but in addition a wide acquaintance throughout the printing and paper trades.

Wood Pulp Rates Hearing Postponed

[FROM OUR REGULAR CORRESPONDENT]

ALBANY, N. Y., September 17, 1934—An extension of time has been asked by the railroads in connection with the hearing relative to import wood pulp rates affecting the local port terminal. The hearing is now scheduled to be held before the Interstate Commerce Commission late in October. Port officials protested proposed new rates advanced by the railroads and were successful in winning a suspension. It was contended that Albany would have higher rates to interior points than ports on the seaboard and that the local port was faced with the possibility of losing foreign trade amounting to several hundred thousands of wood pulp yearly if the proposed rates were made effective. A report that the railroads had withdrawn the new rates was denied here although a request for a permanent suspension was made this week to the Interstate Commerce Commission by the Port Development Commission. Chamber of Commerce organizations in neighboring cities have also joined in the protest as have also a number of prominent paper mill concerns.

The Improved Murray-Waern System of Chemical Recovery
For Soda and Sulphate Pulp Mills



Two 50-Ton Units . .
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The Murray-Waern System Assures:

1. ***Larger Steam Output.*** Through greater efficiency in heat utilization it provides approximately 10,000 lb. of high pressure steam per ton of pulp made under average operating conditions.

2. ***Greater Safety.*** Its design assures protection against the explosion hazards common to chemical recovery processing.

3. ***More Cleanly.*** Close connection between rotary and smelter eliminates escape of dust laden gases to operating room, also preventing admission of large volume of excess air.

4. ***Less Labor.*** Black ash feeds directly from rotary dryer to smelter furnace; no manual transfer required.

Calculated Performance of Hummel-Ross Units:

EVAPORATION—20,200 lb. of steam per hr. (actual) or 24,200 lb. of steam per hr. (from and at 212 F.), when unit is operating at capacity of 50 tons of pulp per 24 hours.

Guaranteed Performance of Hummel-Ross Units:

CAPACITY (each unit)—50 tons of pulp produced per 24 hours, on a basis of 6000 lb. of liquor per ton of pulp, the liquor having 50% solids.

STEAM PRODUCTION—10,000 lb. of steam, from and at 212 F., per ton of pulp.

CHEMICAL RECOVERY—Recovery of 93% of the chemical delivered to the unit in the form of black liquor and salt cake.

CHEMICAL REDUCTION—95% of the chemicals passing through the smelter to the dissolving tank to be reduced.

The Improved Murray-Waern System Lowers Sulphate or Soda Pulp Production Costs . . . . . **Write for Descriptive Folder**

A-183

COMBUSTION ENGINEERING COMPANY, INC.

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Handbook of Northern Wood Industries

A new edition the 6th, of this Handbook has now been published by the *Swedish Timber Journal.* This Handbook contains 832 pages, is written in English, bound in cloth and sells at a price of One Guinea (21 s.) post paid.

The book deals primarily with Sweden, Norway, and Finland. Each country is divided into three sections, viz. the Forest Section, the Wood Goods Section, and the Pulp and Paper Section.

The Forest Section gives information regarding associations and unions active in the forestry branch.

The Wood Goods Section gives full details of the sawmills in the respective country, including the names, addresses, and telephone numbers of the companies owning the mills, as well as output, shipping marks, machinery equipment, management, foreign agents, etc. of each. The information from Finland is arranged in tabular form.

The Pulp and Paper Section provides tabulated information on all the pulp and paper mills of the country, the addresses of the companies, the production and the names of the leading men.

Both the Wood Goods and the Pulp Sections include complete lists of all relevant associations, giving both the Boards and the members of each.

As in the earlier edition, a special Section headed "Timber, Wood-Pulp, and Paper Firms," gives detailed information on such firms not only in Sweden, Norway and Finland but also in the importing countries. The import associations existing in the several countries are also given, mostly with lists of members. This Section is likely to prove very useful, as it is easy to find there the names and addresses of agency firms abroad, and to ascertain rapidly which mills each represents.

For the assistance of buyers, an index is prepared with the sawmills arranged under 30 different Product headings.

The Handbook also contains an alphabetical index of Shipping Marks, giving after each brand the name of its registered owner.

As far as paper and pulp mills are concerned, it may be important to know what particular mills make a certain kind of pulp or paper, and an index is therefore introduced of the mills under 15 different product headings.

All the indices comprise Norway and Finland as well as Sweden.

Also this edition of the Handbook contains a large number of advertisements for members of the branches covered by the Directory and for suppliers of various materials to the Timber, Pulp and Paper Industries. To facilitate the use of this Advertisement Section, a special, classified index of advertisers has been prepared.

The Handbook ends with a very comprehensive General Name Index of not only all companies and firms, but also of persons. In this Index practically every name of any importance in the Timber, Pulp, and Paper Trade in all countries is included.

The price of the Handbook is One Guinea (21 s.) post free, and it may be ordered from Aktiebolaget Svensk Trävaru-Tidning, Kungsgatan 17, Stockholm.

New Palmer-Bee Co. Catalog

The Palmer-Bee Company, of Detroit, Mich., has just issued a new catalog describing P-B Steel and Dropped Forged Chains. This booklet covers the complete and comprehensive lines of P-B Steel and Drop Forged Chains, together with their Sprocket Wheels and includes complete engineering data for application.

J. Scheuerman on West Coast

Among those present at the TAPPI International Convention held at Portland, Ore., was the Mid-West representative of the Cameron Machine Company, Joseph Scheuerman. His visit to the convention, was a prelude to a sales trip that will take him up and down the West Coast, giving him the opportunity to pass along to his

J. Scheuerman

many friends in the industry, the news of the latest developments in slitting and roll-winding equipment.

No doubt, he will spread the word of the big 310 inch wide winder, which the Cameron Machine Company of Canada, Ltd., is shipping to England about the end of September for Edward Lloyd, Ltd.

Norwegian Pulp Industry Active

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., September 19, 1934—The Norwegian chemical pulp industry showed favorable results during the first part of the current year, although it is doubtful if it was able to keep step with the industry in Finland and Sweden, according to reports reaching the Department of Commerce.

Despite trade barriers Norwegian exporters have been able to retain their most important markets and even increase shipments to the United States, Japan and France. Considerable quantities of pulp have been sold recently, the report states, for 1935 delivery, which indicates that consumers are again inclined to make their purchases in advance, in contrast to the hand to mouth policy which has been prevalent during the past few years. It is reported that the European sulphite organization has again decided to restrict production by 25 per cent.

New Worthington-Gamon Bulletins

The Worthington-Gamon Meter Company, of Harrison, N. J., have just released a number of interesting and informative illustrated bulletins, including pamphlets on the Watch Dog Disc Meter—Frost-Proof Model With Open Gear Train; Frost-Proof Model With Enclosed Gear Train; Split Case Model With Open Gear Train and Split Case Model With Enclosed Gear Train. Another booklet describes the Model R. Disc Meter. Copies of these bulletins may be obtained upon application.

CONSTRUCTION NEWS

A Summary of Vital Facts Regarding Construction, Finances and Operation of Paper Mills

Construction News

Whippany, N. J.—The Agar Manufacturing Company, Thomas street, manufacturer of corrugated paper boxes and containers, has work in progress on new addition to plant, for which general contract recently was awarded to the United Engineers & Constructors, Inc., 80 Park place, Newark, N. J. New unit will be one-story, reported to cost close to $100,000, including equipment. It is proposed to have building ready for equipment installation at early date. E. O. Fisher is company architect.

Danville, Ill.—Ball Brothers Company, Paper Mill Division, Muncie, Ind., manufacturer of corrugated paper box materials, containers, etc., has concluded arrangements for purchase of plant and property of the Cornstalk Products Company, Inc., Danville, defunct, manufacturer of pulp products from cornstalk waste. The sale was recently made by the Federal Court at a price of $100,200. New owner is planning to operate the plant as a new branch mill in the near future, supplementing its present plants at Muncie and Eaton, Ind. Improvements will be made in machinery and equipment, including replacements to develop plant for company service.

New York, N. Y.—The Tip Top Paper Napkin Corporation has been organized with capital of 500 shares of stock, no par value, to operate a local paper converting plant for the manufacture of tissue paper specialties. Incorporators of new company include James Xanthos, 904 Union street, Brooklyn, N. Y., and James Michaels, 2425 Jackson avenue, Long Island City.

Covington, Ky.—The Triangle Paper Bag Manufacturing Company, 943 West Sixth street, Cincinnati, Ohio, manufacturer of paper bags and containers, has asked bids on general contract for construction of new plant unit at Covington. It will be one-story, 80 x 120 feet, reported to cost over $35,000, including equipment. General building award will soon be made and superstructure begun. L. B. Goldinger, 2 LeRoy court, Cincinnati, is architect.

Sioux Falls, S. D.—Livingston Brothers Company, Fifth street and Falls avenue, is considering early rebuilding of portion of paper storage and distribution building, location noted, recently damaged by fire. An official estimate of loss has not been announced.

Marion, N. C.—The Etta Paper Box Company, Marion, manufacturer of paper boxes and containers, plans new one-story plant unit, portion of structure to be used for storage and distributing service. It is estimated to cost over $20,000, including equipment. Work is scheduled to be placed under way at early date.

Monroe, Mich.—The Consolidated Paper Company is negotiating with the city for an exchange of land, offering a 10-acre site to the municipality for a proposed municipal sewage plant for a 4-acre tract now owned by the city, the latter to be used ultimately by the Consolidated company in connection with mill operations.

Chester, W. Va.—The Otis Manufacturing Company, manufacturer of paper roofing products, etc., has resumed operations at plant following curtailment for about two months past. It is proposed to adopt a full-time production schedule at early date, giving employment to normal working quota of about 30 persons. E. C. Otis is president.

Chillicothe, Ohio—The Mead Corporation is said to be planning early rebuilding of portion of local experimental laboratory building, recently destroyed by fire, with loss reported over $50,000, including equipment.

East Palestine, Ohio—The Grove Paper Converting Company is running on day and night production schedule at recently established local plant, for the manufacture of spiral wound paper containers and kindred paper products. It is produced to hold to present operating basis for an indefinite period and develop increased capacity as required. The company was formed a few weeks ago, as reported in these columns at that time, and has taken over a modern one-story plant, 60 x 450 feet, with one-story boiler house adjoining, in the eastern part of town, formerly occupied by the New Tread Tire Company. The company is authorized to manufacture and market container-making machinery of automatic type, and plans to engage in this line at later date, in addition to present business. D. W. Benninghoff is president of new company, and E. H. McClure, vice-president.

Providence, Md.—The Jessup & Moore Paper Company is holding to good production schedule at local mill, and has secured Government contracts for paper and postcard stocks to insure continuance of operations on this basis for some months to come.

Racine, Wis.—The Western Printing and Lithographing Company, 1212 Mound avenue, has begun construction of new addition to paper converting plant, to be one-story, 59 x 177 feet, primarily for storage and distributing service.

Glasgow, Scotland—A new company has been chartered by Sir Robert Wilson and associates, with capital of about $250,000, to take over and operate the Dalsholm Paper Mills, Ltd., with plant in Maryhill district of city. The plant has been closed down for a number of years, and will be remodeled and improved by the new company, including machinery replacements and installation of new equipment. The plant will be given over in future to the production of boxboard specialties and large capacity will be developed. It is planned to have the mill ready for service at early date.

Moscow, Russia—The Pulp and Paper Commissariat, Soviet Russian Government, Moscow, is completing plans and proposes early construction of a large new paper mill at Krasnoyarsk, Siberia, where site has been selected.

New plant will consist of several units for the manufacture of different finished paper products, and will be equipped for initial production of about 26,000 tons of newsprint, 36,000 tons of writing and allied paper stocks, and 4000 tons of cardboard per annum. Works will include a pumping station, power house and other mechanical departments. It is reported to cost over $4,000,000, with machinery. The Amtorg Trading Corporation, 261 Fifth avenue, New York, N. Y., is official buying agency for the Soviet Government.

New Companies

St. Louis, Mo.—The St. Louis Label Works, Inc., has been organized to operate a local paper converting plant for the manufacture of labels and allied paper goods. The incorporators are Edgar W. Broemmelsiek and F. B. Buss. New company is represented by M. B. Wood, 806 Wainwright Building, city, attorney.

New York, N. Y.—The Iscow Paperwares Company, Inc., has been organized with capital of 100 shares of stock, no par value, to manufacture and deal in paper products of various kinds. Martin Iscow, 15 East Twenty-sixth street, is principal incorporator and will head new company.

Boston, Mass.—Stimpson & Co. Inc., has been incorporated with capital of $50,000, to deal in paper products of various kinds. Willard H. Loud is president; and Frank L. Jones, 83 Blue Hill Terrace, Milton, Mass., treasurer and representative.

New York, N. Y.—O. W. Wentz, Inc., has been chartered with capital of 100 shares of stock, no par value, to manufacture and deal in paper containers, boxes and allied products. O. W. Wentz is principal incorporator, represented by Benjamin & Galton, 22 East Fortieth street, New York, attorneys.

Southern Alkali Plant Starts

The Southern Alkali Corporation started operation of their new $7,000,000 plant at Corpus Christi, Texas, on September 14.

This culminates a three-year building program and makes the Southern Alkali Corporation, jointly owned by the Pittsburgh Plate Glass Company and the American Cyanamid Company, the pioneer producers of alkali in the far South.

Ideally located on tide water with raw materials and fuel close at hand, this plant will be one of the country's important producers of alkalis.

Indianapolis Demand Improves

INDIANAPOLIS, Ind., September 17, 1934. — Discounting the vacation on Labor Day, business showed some improvement during the past week among the paper trade distributors and manufacturers. Most of them believe the fall season will be well under way by the middle of this month and all are optimistic. Inquiries at the local jobbing houses are increasing, particularly from the printing trades where many plants are figuring on direct mail campaigns and quite a bit of catalogue work.

The opening of the fall season, together with the opening of schools has created quite a bit more local advertising and the lineage for the first week of this month is ahead of the same period last year by a comfortable margin. As a result, newsprint is moving steadily.

Considerably cooler weather has halted demand for summer specialties. Jobbers say they expect little business in these lines from this time until after the first of the year. The demand before Labor Day was good, however.

Container factories in this state continue busy. Production schedules are about the same they have been during the summer and executives report a continued demand from a wide variety of industries. Box board factories also are reported busy. There have been some labor differences in some parts of the state but most of them have been cleared up with a minimum of time lost. Manufacturers of waxed papers report a good volume here. Most of the local output goes to the bakery trade.

Paper stock men are somewhat encouraged. Mills are buying slightly more than they did and prices are holding firm. For that matter, prices on virtually all grades are firm, there being no tendency to shave them to secure business.

Terre Haute Paper Strike Settled

TERRE HAUTE, Ind., September 17, 1934.—A 16-day strike on the part of some of the employees of the Terre Haute Paper Company here was ended when the strikers agreed to return to work following Labor Day under terms agreed upon after a conference with officials of the company. G. T. Watson, secretary of the regional labor board of Indianapolis and John Prechtel of the Central Labor Union here conferred with representatives of the strikers and the company. Hours of work will be governed by the NRA code schedule and the wage rate in effect on Aug. 14 will prevail, the agreement provided.

PICTURE TAKEN AT 23RD ANNUAL CONFERENCE OF HAMMERMILL AGENTS, ERIE, AUGUST 21-22, 1934.

LOCKWOOD'S DIRECTORY

OF THE PAPER AND ALLIED TRADES

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A complete, up-to-date reference book of the paper industry, for the busy executive who must have reliable information at his finger tips.

Entire contents classified under separate headings for the United States and Canada, alphabetically and geographically arranged by states.

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Envelope Manufacturers

Glazed and Coated Paper Manufacturers

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Machinery and Equipment Manufacturers
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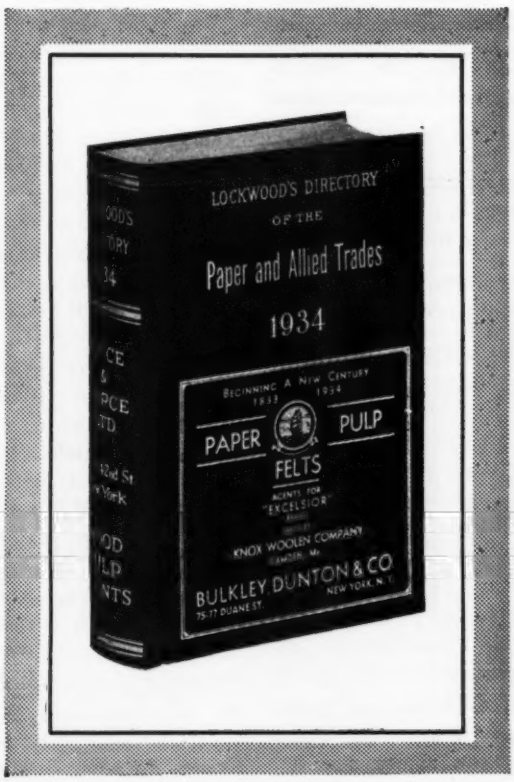
Paper Merchants, United States
Paper Stock and Rag Dealers
Paper Bag Manufacturers
Paper Box Manufacturers



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This publication is now and always has been printed on paper made in the U. S. A.

COMING EVENTS

National Paper Trade Association, fall convention, Hotel Stevens, Chicago, September 24-26, 1934.

Paper and Pulp Section, National Safety Council. annual convention, Hotel Statler, Cleveland, Ohio, October 1-5, 1934.

THE TAPPI COAST CONVENTION

The Technical Association of the Pulp and Paper Industry made history last week. Its convention at Portland, Ore., September 10-13 was the first TAPPI national convention ever held on the Pacific Coast. This convention was in fact the first national convention of paper men ever held west of the Rocky Mountains.

It was a novel idea to hold the convention in this comparatively new territory so far as Tappi conventions are concerned. It was conceived, we believe, as a distinct compliment to the newly formed Pacific Coast Section and also, of course, as a recognition of the considerable growth recently in the size and importance of the pulp and paper manufacturing industry on the Pacific Coast. There was never any doubt, naturally, about the ability and the willingness of the Coast members to provide the machinery of a convention to meet all the TAPPI standards, but because of the great distance, there was some concern about attracting a sufficient number of technical men from the pulp and paper mill centers of the East, Middle West and South to make the convention truly representative of the entire country.

But these doubts were needless. Especially when the great distance that it was necessary for some of the members to travel is taken into consideration, the attendance was splendid. And it is venturing no bold assertion to say that particularly as concerns those who viewed for the first time all the impressive treasures of the coast scenery, the trip was more than worth while. In addition to the thrills provided by nature, there was, of course, the educational value provided by viewing from the logging operations the process of pulp and paper manufacture in the new mills of the Coast about which so much has appeared in print, but which must be personally seen in order to be fully and adequately appreciated.

Judging from the reports, the convention was a big success in every respect and the PAPER TRADE JOURNAL predicts that in the not very remote future, the Pacific Coast members will care to arrange another convention and technical men in the pulp and paper industry of the East, Middle West and South, as well as elsewhere, will in even greater number gladly accept the invitation to see and enjoy all the good things and to become acquainted with all the advantages provided by the Pacific Coast.

MODERNIZING PLANT EQUIPMENT

The movement to modernize plant equipment, thereby reducing power service costs, and thus helping to restore industrial profits will reach a climax at this year's National Exposition of Power and Mechanical Engineering. The Exposition which occurs only every two years, will be held during the week of December 3 to 8, at Grand Central Palace, New York City. New operating exhibits will reveal the latest developments in mechanical engineering. The exhibitors who have already taken exhibit space range from the largest long established corporations to new industrial organizations of more modest size.

Dynamic exhibits designed to tell their story clearly, will prove that power service costs can be cut by installing the most modern equipment. The exposition thus is keyed to a theme which now is assuming national importance. Simple and sound is the argument which underlies the extensive editorial opinion and industrial advertising which is being directed to the same subject. Manufacturing industry has three major expenses: materials, labor, and power services. In other words, the material, the man, and the machine. The "power service" classification is broad and involves all elements other than the materials and man-power, namely, every item or expense for generating, transmitting, and utilizing the power which is necessary for whatever kind of manufacturing a given company undertakes. In the first two classifications, that is, materials and labor, industry may expect to pay more for each, not less. This leaves only power services—the third classification—as a possible field for cost reduction.

That power service costs can and should be reduced is a point which experts have long been urging. Statisticians of one leading publication in the field of factory operation find that three quarters of a billion dollars of industry's total power and fuel bill could be saved through the installation and efficient operation of modern equipment. This amount is more than the total for dividends paid by the entire manufacturing industry in 1933.

What has delayed the modernization of industrial power? The decision to purchase modern equipment which will make possible reductions in power cost is being made every day by an increasing number of corporations,

large and small. In the case of some companies the greatest obstacle is the difficulty which corporation executives encounter in balancing, to their own satisfaction, the potential savings against what money they have to spend. The Exposition of Power and Mechanical Engineering provides a market place where those who have the problem of purchasing equipment to cut power costs can examine competitive devices side by side using the eye to supplement other methods of impression. Scheduled for December of the present year, the Exposition is so timely as to suggest a coincidence. However, the Exposition was scheduled even before the movement to modernize had begun to assume its present proportions.

Inquiries at this time while the Exposition is taking shape reveal that the greatest interest is centered on complete power plants; on boilers—and here is noted the tendency to operate at increasing pressures; on air conditioning equipment; industrial refrigeration equipment; and Diesel engines.

Since, materially speaking, nothing is more fundamental in the operation of industry than power, the present modernizing of boiler plant facilities by a typical cross section of industry is a rainbow sign that the expectation of better business is becoming definite. The extension of steam generating facilities and the modernization of existing equipment is proof that production expects to go forward. Now, actually, is the time this modernization is getting under way, and accordingly the Exposition of Power and Mechanical Engineering is to be congratulated upon its date. Following the 1934 Exposition the next will not occur until 1936.

Tasmanian Gumwood for Newsprint

[FROM OUR REGULAR CORRESPONDENT]

VANCOUVER, B. C., September 14, 1934—"Particularly promising" tests of Tasmanian gumwood, made recently at Ocean Falls, B. C., may some dav lead to the establishment of newsprint manufacturing in the Antipodes.

John A. Young, vice-president of Pacific Mills, Ltd., at whose plant the tests were made, refused to comment on the possibility of immediate construction of a mill by Australian or New Zealand promoters.

"We have, at Ocean Falls, made a mill run and the results have been particularly promising," he said.

Mr. Young was quick to point out, however, that the result of these tests does not mean that domestic newsprint can be manufactured in Australia for the Antipodean trade at present price levels.

Australia and New Zealand imported a total of 133,000 tons of newsprint from other countries last year. Of this amount 70,000 tons were bought from Great Britain while 58,000 tons were produced in Canada.

Pacific Coast manufacturers point out that Canada's share of this tonnage is split among various mills.

Australian and New Zealand interests have been experimenting for some time in the hope of manufacturing newsprint at commercial prices. One adventurous syndicate actually bought the complete model paper making machine at the British Empire Exhibition and transported it to Australia.

Newsprint was manufactured on this machine, but not in commercial quantities. Kraft papers are already made in the Antipodes.

The Paper Trade Assessment

A. W. Leslie, chairman of the Code Authority of the Paper Distributing Trade, has sent out the following letter with the Code Authority assessment invoices:—

FELLOW PAPER MERCHANTS:

Here is an invoice covering your share of the cost of Administration of the Code for the Paper Distributing Trade for the Year 1934.

The Code Authority has been granted power by the administrator to levy a fair and equitable assessment upon each member of the trade. The Administrator has approved our budget and basis of contribution.

The payment of this assessment is, therefore, mandatory. In fairness to the trade as a whole, it is the duty of the Code Authority to see that each member of the Trade does his full share in financial support of Code activities.

Legal means are readily available for the collection of assessments.

However, the Code Authority very much prefers that every member of the Trade shall pay his assessment willingly, and confident that his contribution will be intelligently used in effecting realistic benefits to the trade at large and to each member in particular. Provisions of our Code permit, for the first time in many years, a high degree of lawful cooperative action. Enlightened self-interest quickly recognizes the new opportunity and has already demonstrated its willingness to pay the price. The following brief and incomplete list of Code activities suggests the value of your investment:

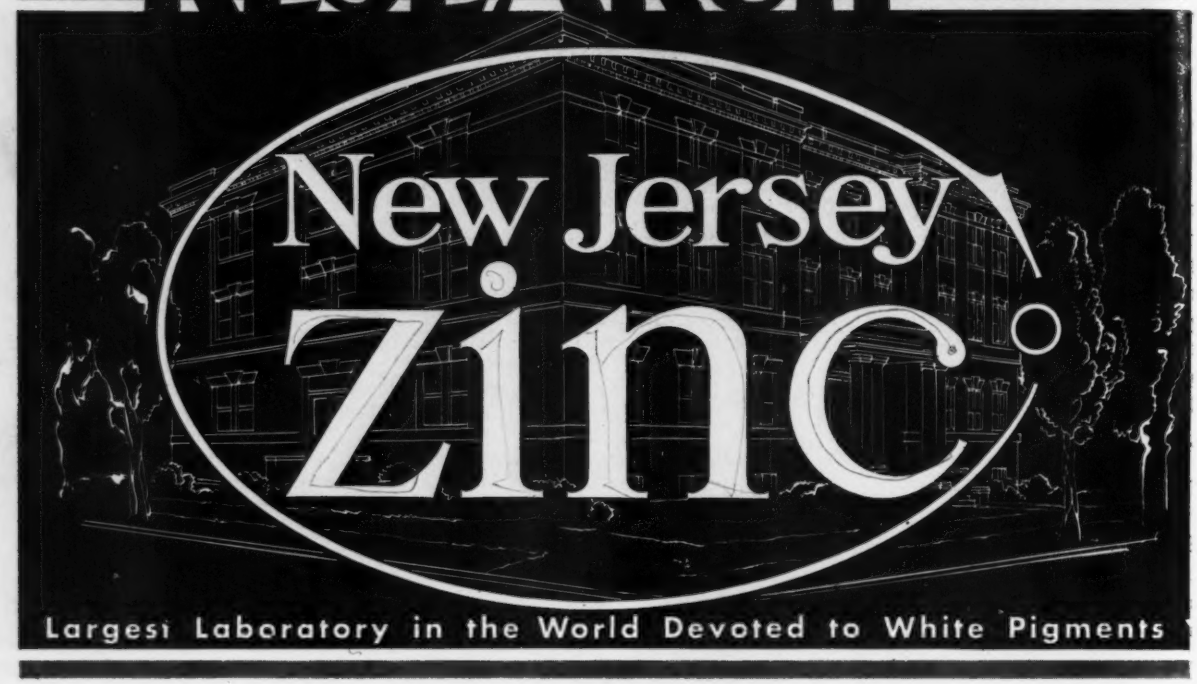
(1) Lawful arrangements and agreements with the manufacturers from whom we buy—through their Code Authorities.
(2) Regulation of manufacturers operating as distributors with a view to eliminating unfair competition with regularly organized paper merchants.
(3) Regulation of the transactions of chain organizations competing with paper merchants.
(4) The privilege of operating an open price reporting plan in regions and on commodities where benefit to the trade may accrue.
(5) Protection afforded by our cost being defined as "replacement cost."
(6) Establishment of "wage allowance" as a mandatory addition to "replacement cost." The beneficial result of this provision is to more nearly equalize the competition of side line merchants.
(7) Regulatory authority over the sale of seconds, job lots, close-outs lots, with the cooperation of Manufacturers' Code Authorities.
(8) Collection of vital statistics of the Trade for the purpose of encouraging enlightened merchandizing and management.
(9) Regulation of unfair competition in the form of manufacturers selling direct by means of the establishment of differentials under the provisions of the General Wholesaling and Distributing Code.

Our Code gives us the right and privilege of self government. Your Code Authority is determined that the cost of self government shall be reasonable and that we shall obtain full value for our expenditures. In view of this pledge we ask your willing and prompt remittance.

A. W. LESLIE, Chairman.

The Brown Company has announced that the C. M. Rice Paper Company, Portland, Me., has been appointed as distributor for its line of printing papers. This distributing organization will represent all lines with the exception of Nibroc bond and Nibroc ledger.

RESEARCH



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Section of the
Technical Association of the Pulp and Paper Industry
Edited by Ronald G. Macdonald, Secretary

Theory of Absorption Applied to the Sulphite Tower*

W. L. Beuschlein[1] and Frank H. Conrad[1]

Abstract

The film theory is applied to the sulphite tower for the determination of the overall resistance to absorption. A method has been given for indicating the effect of tower operating characteristics. Some pressure-composition curves are presented for the system CaO-SO_2-H_2O for the temperatures 15 and 25 deg. C.

According to the film theory, a film during absorption represents a region in a tower wherein matter is transferred only by diffusion. This concept has been applied with considerable success for the calculation of the capacity of absorption towers when operating under various conditions. For the application of this theory, equilibrium data are necessary, which for the system CaO-SO_2-H_2O has only recently been made available by Conrad and Beuschlein *(2)*. The present paper describes a method for applying the film concept to the operation of sulphite acid towers.

The removal of gaseous SO_2 from an inert carrier gas, followed by its solution in water running over limestone may be divided into several steps or operations. The gas-liquid interface represents contact between two films, gas and liquid, thru each of which sulphur dioxide must diffuse. At the interfacial layer in the liquid film, sulphur dioxide enters into solution forming both sulphurous acid and dissolved sulphur dioxide. Since the ratio of sulphurous acid to dissolved sulphur dioxide is constant under iso-thermal conditions, and independent of the external pressure, for purposes of simplicity in this paper, sulphur dioxide in water will be considered to be completely hydrated to sulphurous acid, and to exert its true partial pressure. Consequently as sulphurous acid forms in the liquid at the interfacial boundary the concentration increases thereby forming a diffusion potential with consequent diffusion of sulphurous acid thru the liquid film. If the water layer over the limestone packing be sufficiently thick, a turbulent region will be present which is bounded by two films, one in contact with the gas phase, the other in contact with the solid phase or lime rock. Sulphurous acid from the outer liquid film enters the turbulent stratum wherein convection and eddy currents maintain the acid concentration uniform. Applying again the potential concept to the liquid film adjacent to the lime rock packing, reaction of sulphurous acid at the solid surface with calcium carbonate diminishes the acid concentration, thereby setting up a concentration gradient across the film. Such a gradient may be thought of as a concentration potential. Hence in the region of the tower where lime is being dissolved, three films may be found, namely, gas and liquid films at the gas-liquid interface and the liquid film at the lime rock-liquid interface. Where the water layer does not accommodate a turbulent region, the two liquid films may be combined.

In the diagram of Fig. 1, the films have been drawn in section as definite layers with vertical distances representing concentrations. In the liquid film adjoining the solid surface, a series of reaction zones after Davis and Crandall *(3)* is shown as partially shaded areas wherein concentrations of reaction products are set up. The reaction products of a zone diffuse outward, reacting with those from adjacent zones. The aqueous layer in contact with lime stone is saturated with calcium carbonate. The carbonate diffuses outward, meeting carbonic acid whereupon the bicarbonate diffuses toward both the solid surface and main body of solution. In the latter region, the reaction

$$Ca(HCO_3)_2 + Ca(HSO_3)_2 = 2\ CaSO_3 + 2\ H_2CO_3$$

takes place. Carbonic acid diffuses to the gas-liquid in-

DIAGRAM OF ABSORPTION PROCESS SHOWING FILMS

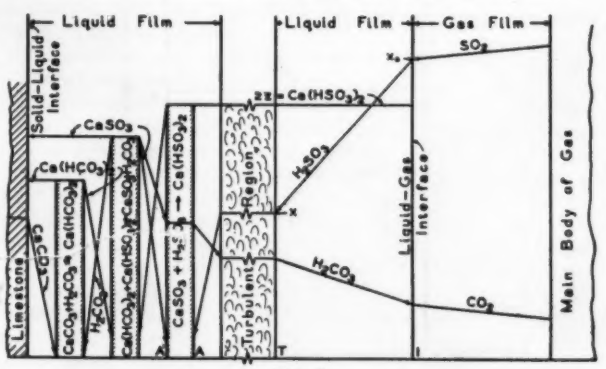

FIG. 1

* Presented at the fall meeting of the Technical Association of the Pulp and Paper Industry, Portland, Ore., Sept. 10 to 13, 1934.

[1] Dept. of Chemical Engineering, Univ. of Washington, Seattle, Wash.

terface and carbon dioxide enters the gas phase. Calcium sulphite will react with sulphurous acid to form calcium bisulphite which diffuses to the gas-liquid interface. The bisulphite concentration is essentially constant in the fluid layer bounded by the reaction zone A' and the gas liquid interface. The diagram has not been drawn to scale, the films comprising a very small fraction of the fluid layer, and the composition of the turbulent portion is that reported by a chemical analysis of a tower solution taken at the section under consideration.

When we recall that Fig. 1 applies to any section of the absorption tower wherein lime stone is present, as this section is moved along such a tower, concentrations will change. The absorption at any section of the tower equals that sulphur dioxide which diffuses thru the gas film and this quantity must equal that which diffuses thru the adjoining liquid film. These facts are represented by the basic absorption equations.

$$\frac{dw}{d\theta} = \frac{a\,A\,(C_e - C)\,dh}{r_L} \qquad (1)$$

$$\frac{dw}{d\theta} = \frac{a\,A\,(\Delta\,p)\,dh}{r_G} \qquad (2)$$

A table of nomenclature is given at the end of this article. Equations 1 and 2 are for the liquid and gas films respectively and can be used directly when either the gas or liquid film resistance is negligible compared with that for the other film. Under such conditions, the controlling film resistance becomes numerically equal to the overall resistance (R).

In the absorption of sulphur dioxide by water Henry's Law does not hold and the apparent overall resistance, R, cannot be obtained directly. Adams *(1)* working with sulphur dioxide and water has determined individual film resistances for a spiral packed tower. He shows that at 75 deg. F., with liquid velocities less than eight pounds per minute per square foot and gas velocities greater than 1.2 pounds per minute per square foot, the diffusion of sulphur dioxide is controlled by the liquid film resistance. As the temperature is lowered below 75 deg. F., the liquid film resistance increases more rapidly than the gas film resistance decreases. The usual lime stone packed tower operates at temperatures below 75 deg. F. and frequently with liquid and gas velocities of 8 and 1.5 pounds per minute per square foot respectively. It may be quite safely concluded that in the latter system, the liquid film resistance will control the absorption of sulphur dioxide. When r_L equals R_L, equation (1) becomes,

$$\frac{dw}{d\theta} = \frac{a\,A\,(C_e - C)\,dh}{R_L}. \qquad (1a)$$

From known operating data taken at the mill this equation can be used to study and predict the effects of changing certain variables such as gas pressure, liquid concentration, and temperature.

A sulphite tower is shown in Fig. 2. Under conditions of steady flow, a material balance for the differential section dh can be written as:

$$G\,dy = \frac{L\,dt}{100}$$

which integrates into:

$$G\,y = \frac{L\,t}{100} + \text{constant}. \qquad (3)$$

At the gas exhaust end of the system, the values for y and t are known and substitution of them into equation (3) determines the constant of integration. Equation (3) then becomes an obvious material balance:

$$G\,(y - y_o) = \frac{L}{100}\,(t - t_o). \qquad (4)$$

This equation is useful for calculating concentrations of sulphur dioxide in gas and solution along the length of a tower when G, L, and either set of terminal conditions are known.

Absorption rate can be expressed as:

$$\frac{dw}{d\theta} = a\,A\,\frac{L}{100}\,dx \qquad (5)$$

DIAGRAM OF ABSORPTION TOWER

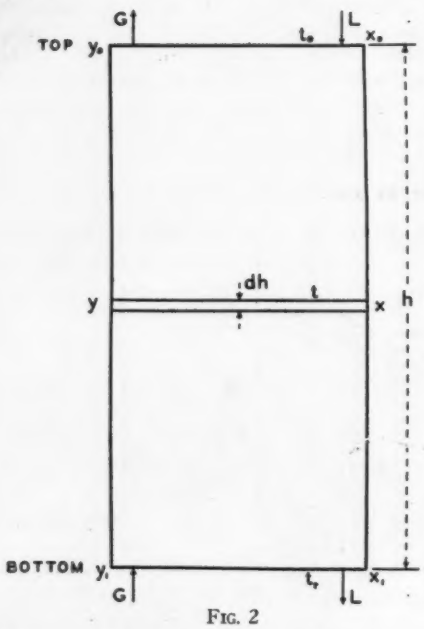

FIG. 2

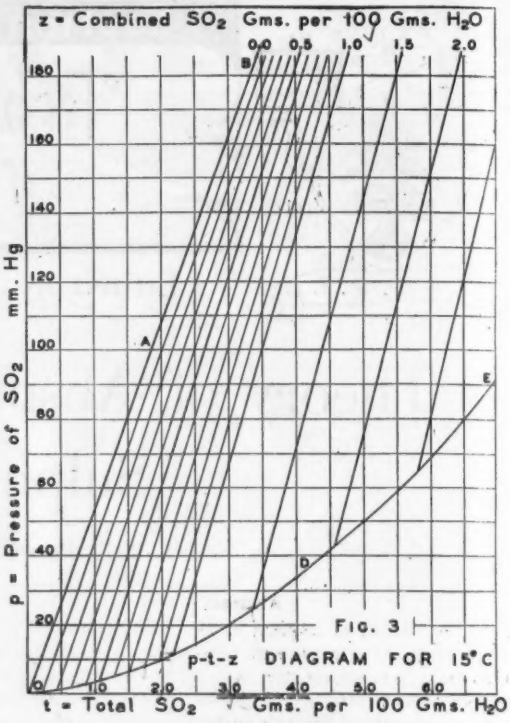

FIG. 3

p-t-z DIAGRAM FOR 15° C

From equations (1a) and (5) by elimination of $\frac{dw}{a A d\Theta}$,

$$\frac{L}{100} dx = \frac{(C_e - C)\, dh}{R_L} \qquad (6)$$

The density of the tower solution varies slightly along the tower, ranging from 1 to 4 Be. corresponding to an average density D of 1.02. The variables x, c and C are related by the equations:

$$C = 62.3\ c = \frac{62.3\ D\ x}{100 + x},$$

replacing the values of C in equation (6), and collecting,

$$\frac{dx}{\frac{x_e}{100 + x_e} - \frac{x}{100 + x}} = \frac{6230\ D\ dh}{L\ R_L} \qquad (7)$$

For very small values of x, the quantity $(100 + x)$ becomes nearly 100 and equation (7) can be simplified into:

$$\frac{dx}{x_e - x} = \frac{62.3\ D\ dh}{L\ R_L} \qquad (7a)$$

In the diagram of Fig. 1, gas and liquid are in equilibrium at the gas-liquid interface, the concentration x_e of sulphurous acid holding only for the interfacial liquid layer. The concentration x of sulfurous acid in the turbulent layer subtracted from x_e represents the driving force across the film I-T. For conditions justifying major diffusional resistance in the liquid film, the concentration of sulphur dioxide in the gas phase at the gas-liquid interface equals that in the main body of gas. Concentrations in the gas can be obtained from equation (4), and it is necessary to translate these into sulfurous acid concentrations x, which will exist at the liquid-gas interface.

Smith and Parkhurst (*6*) show that the concentration of free sulphur dioxide or sulphurous acid in water and in calcium and magnesium hydrogen sulphite solutions is exactly and directly proportional to the partial pressure of sulphur dioxide above the solution at all temperatures,

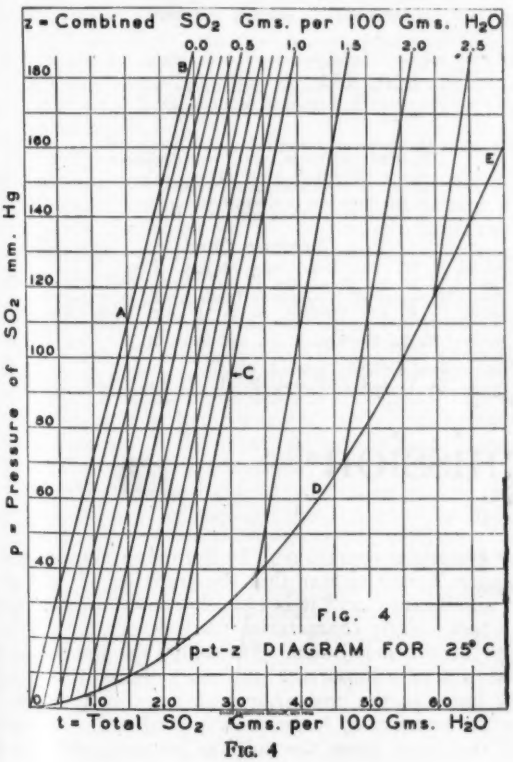

FIG. 4

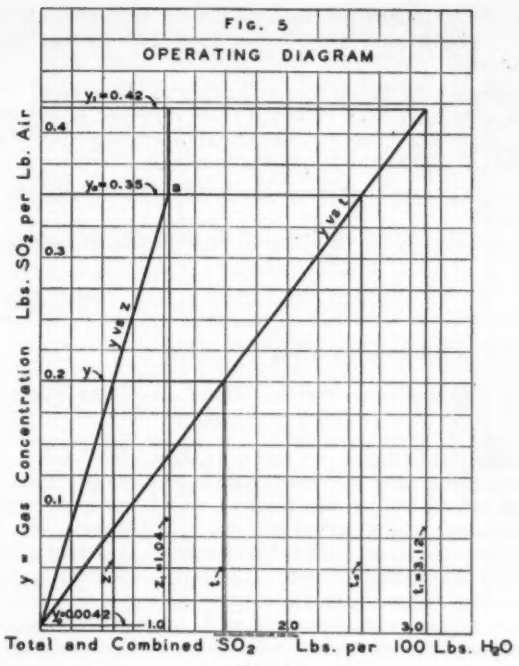

FIG. 5

alkali concentrations and pressures within the range investigated. Their study covered the ranges: for temperature, 5 to 60 deg. C., for alkali concentrations, 0 to 1 N, and for pressures, 46.6—595.3 mm Hg. The curves shown in Figs. 3 and 4 have been constructed on such a basis using the equilibrium data of Conrad and Beuschlein (*2*), line ODE, which is the solubility of total sulphur dioxide in aqueous solutions saturated with lime and, the line OAB which is the solubility of sulphur dioxide in water (*5*). The straight lines of positive slopes are constant combined lines. Areas under the curves ODE represent conditions of supersaturation. For each diagram, the abscissa is read in units equivalent to free sulphurous acid (x) when using the line OAB, and in units of total sulphur dioxide (t) for points in the area BEDOA. As an example, the equilibrium pressure of a solution at 25 deg. C. is desired and the solution is known to contain 1.0 gram combined and 3.0 gram total sulphur dioxide per 100 grams of water. The point C in Fig. 4 determined by the analysis locates the constant pressure line of 95 mm. The free sulphurous acid is calculated from the equation:

$$x = t - 2z$$

Obviously, with any two of the variables (x, t, z) known, the third can be determined.

The solution and applications of equation (7) can best be demonstrated by considering a practical example. A standard tower acid comprising 3.00 per cent total and 1.00 per cent combined sulphur dioxide is obtained from two towers in series. Recovery of gas in the two towers is distributed as 95 per cent in the strong tower and 4 per cent in the weak tower. The sulphur burners consume 15 tons of sulphur per day and produce 16 per cent sulphur dioxide gas which, after cooling, enters the absorption system at 15 deg. C. The gas sampled at the bottom of the lime stone packing analyses 13.7 per cent sulphur dioxide. Water at 15 deg. C. is sprayed into the top of the weak tower and absorption will be considered as taking place at the same temperature.

The average density of the tower liquor is 1.02. The

upper three fourths of each tower are packed with lime stone. The towers are 75 feet high and 10 feet inside diameters.

Determine the liquid film resistance to absorption.

The data have been collected from different sources and hence may not describe an actual operating unit. The method of application is general however.

The diagram in Fig. 5 indicates the conditions of operation.

Reducing the data to units used in the table of nomenclature:

$A = 78.5$	$y_e = 0.0042$	$t_e = 0$	$z_a = 1.04$
$G = 1.265$	$y_a = 0.35$	$t_1 = 3.12$	$z_1 = 1.04$
$L = 16.85$	$y_1 = 0.42$	$z_e = 0$	

A material balance, equation (4), gives:

$$L\,(3.12 - 0) = 100\,G\,(0.42 - 0.0042) \text{ and } \frac{L}{G} = 13.30 \text{ and } 0.133\,t = y - 0.0042 \qquad (8)$$

Equation (8) is linear in t and y as shown in Fig. 5.

For a given class of tower packing and temperature, the rate at which lime rock dissolves will be proportional to the free acid in the turbulent layer. This means that the ratio of combined to total sulphur dioxide is constant thruout the lime packed system. The gas concentration y_a is that at the base of the lime stone packing, the straight line $y_e a$ representing the combined sulphur dioxide concentrations at points along the tower corresponding to gas concentrations y.

Figs. 3 or 4 with 5 are used for the integration of the left-hand term of equation (7a). In this equation, concentrations of free sulphurous acid are necessary and these are expressed in terms of combined and total sulphur dioxide concentrations in Figs. 3 and 4. Referring to Fig. 5 a sulphur dioxide concentration of (y) at a given section of the tower (h) corresponds to combined and total sulphur dioxide concentrations in the tower liquor of z and t respectively. Since y is expressed in pounds of sulphur dioxide per pound of air, and the equivalent as x_e is desired, y is transposed to pressure units and with the aid of Fig. 3, the corresponding value of t_e is read from the pressure-total sulphur dioxide curve for z units of combined. In the same figure, the known values of z and t are translated into a free sulphur dioxide concentration x, or the equation $t - 2z = x$ can be used. It has been indicated that equation (7a) may be used when $100 + x$ is close to 100 which applies to this case. A plot was made of $\frac{1}{x_e - x}$ versus x and the area under the curve between the limits of $x = 0$ and $x = x_a = 0.53$ gave the desired integration.

Following the above proceduce, the unit overall diffusional resistance for the lime packed section has been found to be $R = 160$. This resistance is mainly in the liquid film. In the lower section of the strong tower where no lime packing is used, the combined sulphur dioxide concentration of the tower liquor is constant as indicated at a in Fig. 5. The diffusional resistance, $R = 120$ for this section was obtained by a similar integration, z being constant and the limits of x being x_a and $x_1 = 1.04$.

Discussion of Results

After the unit resistances to absorption for each section of the towers have been determined, the effect of operating at 25° C. can be approximated. Rewriting equation (7a) for the two sections:

$$\int_{x=0}^{x=x_a} \frac{dx}{x_e - x} = \frac{(62.3)\,(1.02)\,(0.875)\,(150)}{160\,L} = \frac{52.1}{L} \qquad (9)$$

$$\int_{x=x_a}^{x=x_1} \frac{dx}{x_e - x} = \frac{(62.3)\,(1.02)\,(0.125)\,(150)}{120\,L} = \frac{9.9}{L} \qquad (10)$$

where equations (9) and (10) represent packed and unpacked sections respectively.

The temperature effect upon liquid film resistances for sulphur dioxide has been investigated by Adams *(1)*, and by Haslam, Hershey, and Kean *(4)*. For the temperature change 15 to 25 deg. C., the overall resistance may be considered constant and equations (9) and (10) will represent the conditions to be fulfilled at 25 deg C. A liquor flow L must be selected by trial to satisfy the equations. The effects of changing rates of fluid flow and of concentrations can easily be predicted.

TABLE OF NOMENCLATURE

- a = specific area of gas-liquid interface, sq. ft./sq. ft. of empty tower cross section.
- A = cross sectional area of empty tower, sq. ft.
- c = concentration of free SO_2 in solution, gms. SO_2/cc.
- C = concentration of free SO_2 in solution, lbs. SO_2/ cu. ft. = 62.3 c.
- D = density of tower solution, gms./cc.
- G = carrier gas velocity, lb./min./sq. ft.
- h = height of tower, ft.
- L = water velocity, lb./min./sq. ft.
- p = pressure of sulphur dioxide, mm. of Hg.
- r_G = diffusional resistance of gas film.
- r_L = diffusional resistance of liquid film.
- R_L = overall diffusional resistance.
- t = total sulphur dioxide in solution, gm./100 gm. water = lb./100 lb. water.
- w = weight of sulphur dioxide, lb.
- x = free sulphur dioxide in solution, gm./100 gm. water = lb./100 lb. water.
- y = sulphur dioxide in gas, gm./gm, carrier gas = lb./lb. carrier gas.
- z = combined sulphur dioxide in solution, gm./100 gm. water = lb./100 lb. water.
- θ = time, min.

Subscripts: U, section of tower not packed with limestone. P, section of tower packed with limestone. o, gas exhaust of tower system. a, end of limestone packed system. 1, gas entrance to tower system. e, equilibrium conditions.

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Heat Transmission*

By Charles S. Keevil[1]

Abstract

A review of the principles of heat transfer together with illustration of their application to pulp and paper mill heat transfer equipment.

Few are the industries in which heat transmission is not an important operations. In the manufacture of pulp and paper it may appear that the transfer of heat is of minor significance, and it is true that many of the operations which chiefly characterize the industry have little to do with heat transmission. However, the drying of the product is a very important step, not only as it affects the quality but also the cost of manufacture, and drying involves the transfer of large quantities of heat. The cooling of the gases from the sulphur burners, prior to ab-

* Presented at the fall meeting of the Technical Association of the Pulp and Paper Industry, Portland, Ore., Sept. 10 to 13, 1934.
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sorption, is a heat transfer problem; and the evaporation of waste liquors, for purposes of recovery or disposal, is another application. It may be of interest, therefore, to consider briefly some principles of heat transmission.

The three mechanisms by which heat may be transferred are conduction, convection, and radiation. The conduction of heat through a solid is summarized by its coefficient of thermal conductivity, which expresses the rate at which heat will flow through a unit cube of the material when there is a temperature difference of one degree. Values of this coefficient are known for all the common metals and insulating materials, covering the range of temperatures usually encountered, so that calculations for this case are easily made.

The Film Concept

When a fluid is being heated or cooled in contact with a solid, heat is carried about within the fluid by convection currents. At the surface of contact there exists a relatively stationary film of fluid, through which the heat must pass by conduction. The thickness of this film depends largely on the viscosity of the fluid and on its velocity past the surface. The thicker the film, the greater its resistance to the flow of heat. For fluids in turbulent motion it is usually considered that the main body of the fluid is at a uniform temperature, and that the temperature drop between fluid and solid is through the fluid film. In other words, the film offers the resistance to the flow of heat. The film concept greatly simplifies the treatment of cases where there are several resistances in series. For example, where heat is transferred from condensing steam to water, in a surface condenser, the heat must pass successively through the film of condensate, the metal wall, and the water film. A calculation of the individual resistances shows the relative importance of each, and their sum gives the total resistance. Additional resistances, resulting from the accumulation of non-condensible gas in the steam, or from the formation of scale on the tubes, may be determined from experiment or estimated from previous experience, and their effects on the performance of the unit taken into account. This method of procedure gives a much better understanding than is gained by using overall coefficients of heat transfer which obscure, while they include, the individual effects.

All bodies radiate heat to their surroundings at a lower temperature, and receive radiant heat from objects at a higher temperature. Heat is radiated at a rate proportional to the fourth power of the absolute temperature, so that this mechanism becomes increasingly important at higher temperature levels.

All three mechanisms are represented in the cooling of the gases from a sulphur burner. The hot gases first pass through iron pipes, where they give up heat by convection and also to some extent by radiation from the gas to the inner pipe surface. The heat is conducted through the metal wall, and is then dissipated to the air by convection and radiation. In the lead pipe section heat passes from the metal to the cooling water by convection.

The new method of digester operation, where the cooking liquor is recycled through an external heater, has much to recommend it from the viewpoint of obtaining effective heat transfer. A good coefficient can be obtained by means of a high liquor velocity past the heating surface, and by operation at a consistently high temperature level. This, combined with the large temperature difference that can be employed in such a heater, will permit the use of a comparatively small area for the required capacity. Maintenance of a large temperature difference between heating medium and cooking liquor will also materially reduce the pressure drop due to friction, and thus minimize pumping costs. This is true because the friction is largely determined by the viscosity of the film of liquid next to the pipe wall, and under the operating conditions described the film will be much hotter than the main body of the liquid and will therefore have a lower viscosity. An external heater will make it possible quickly to raise the entire quantity of cooking liquor to the desired operating temperature, and should therefore facilitate the reaction. There will remain the problem of securing effective circulation through the mass of chips.

In the drying of pulp and paper large amounts of heat must be transferred. Where condensing steam is used to heat the drier rolls, good practice provides for the efficient removal of non-condensible gases which, if allowed to accumulate, offer considerable resistance to the transfer of heat. The drying of the sheet can take place no faster than the necessary heat is supplied. This applies particularly to the evaporation of moisture which takes place at the surface of the sheet. The mechanism of drying includes the diffusion of moisture to the surface, and this is promoted by heat penetrating within. In some cases, as with relatively thick dense sheets, the rate of diffusion may be so slow as to control the process, no matter how much heat is available for surface evaporation. In such cases it is evident that the use of forced air circulation or other means to promote surface evaporation will be of little help. However, where diffusion is rapid, and surface evaporation controls, such methods are desirable. A current of warm air not only supplies sensible heat but also serves as a vehicle to remove the evaporated moisture. Attention has been directed to the large amount of heat carried off in the humid air from a drier, and economizers have been installed to recover some of this heat in preheating the incoming air, and in supplying tempered air to other departments of the mill for purposes of heating and ventilating.

Two of the most important factors that determine the coefficient of heat transfer between a solid and a fluid are the velocity of the fluid and its viscosity. The higher the velocity and the lower the viscosity, the better the coefficient. These principles have been applied in the forced-circulation evaporator. Its design permits the use of high pressure steam as the heating medium, and the accompanying high temperature results in a comparatively low film viscosity in the liquid being evaporated. Positive circulation by means of a pump ensures a high velocity past the heating surface. As a result, this type of evaporator seems well adapted to the treatment of viscous solutions. It may be used as a source of low pressure steam for process requirements.

The design of heat transfer equipment is still based largely on empirical rules, which have been slowly developed through experience. Where a need existed, equipment was built and tried, and the process repeated until something that would work was obtained. In some cases early designs have been perpetuated, in spite of the fact that much of this equipment is not nearly as efficient as it should be possible to build it. In recent years remarkable progress has been made in the study of the variables that influence heat transfer coefficients. Working with clean fluids, in short lengths of clean pipe, the investigator has been able to determine the effect of the velocity of the fluid, and of changes in such properties as viscosity, density, specific heat and thermal conductivity. As a result, a much better understanding of the subject has been gained. However, these laboratory studies do not take into account the many variables that enter into the construction and performance of commercial equipment. The publication of reliable test data on commercial units would be of great service.

Modern Electrical Equipment In the Pulp and Paper Industry*

By R. V. Maier[1]

Recent years have witnessed many improvements in the machinery and processes used in the pulp and paper industry. Electricity has for many years been an important factor in the economical manufacture of paper and the following article summarizes the apparatus as developed by a leading electrical manufacturer applicable to the industry.

These developments embody new apparatus as well as new applications of existing apparatus. Control equipment has been improved and simplified, providing greater safety to operators and increased protection for driving and driven machines.

Paper Machines

The paper machine is the most important single machine in the mill. Continuous operation is essential, requiring a flexible, dependable low maintenance drive engineered to the particular requirements of the machine under consideration.

Each section of the machine may be driven by an individual direct current motor or from a line shaft through suitable cone pulleys, belts and clutches. The line shaft may be driven by a geared steam turbine or an adjustable speed direct current motor.

Sectional Drive

The principles of sectional paper machine drive involving the use of moderate speed, geared, adjustable voltage, direct current motors and a direct current generator are will understood. The speed of each motor is controlled by an individual speed regulator so as to permit relative speed adjustment or "draw" and also to maintain the correct section speed.

A differential Selsyn operated compression resistor has been developed for use as a speed regulator. The development of the Selsyn regulator permits the regulator proper to be mounted on the main control panel, and installed remote from the paper machine in locations free from excessive dirt or moisture. This feature minimizes the chances of mechanical injury to the apparatus, and also prevents unauthorized persons from tampering with the equipment. A simple transmitter unit is located on the machine room floor, driven by means of a belt from the section motor. Selsyn units as applied to this apparatus also provide remote control of the draw from the front side of the paper machine, and slack take-up features for the calender sections. For example, when threading up the calender section, the operator can readily take up the slack between the dryers and calenders without disturbing the relative draw adjustment of the two sections.

The machine tender has complete control of the speed of the machine by turning a rheostat handle, and may shut down the whole machine in case of emergency by pushing a button. Control stations are provided for the individual sections to give "run", "slow-speed", and "jog". The equipment provides overload and undervoltage protection for the various motors and preset speed control of the whole machine.

Individual ammeters at each control station provide a check on the operation of the individual sections. For example, if water collects in the dryers, the running load will materially increase, thus advising the machine tender of an inefficient drying condition.

Power is supplied to the motors from a direct current generator operating at constant speed. The generator may be driven by synchronous or induction type alternating current moters, geared steam turbine or engine. Both steam turbine and synchronous machine may be used, forming a heat balance set. The main generator and exciter voltages are controlled within close limits by voltage regulators. The main control elements of the voltage regulators are in principle accurate sensitive contact making voltmeters and are described in detail under the heading "Speed Regulators for Single Motor Paper Machine Drives." The main control element in conjunction with the motor operated rheostat may be guaranteed to correct the regulated voltage within .5 of 1 per cent plus or minus from a mean value.

Due to minimum space requirements, flexibility and simplicity of control, exact speed regulation and low maintenance, the sectional drive is ideal for the paper machine.

Steam Turbine for Line Shaft Drive

In paper mills, a proper balance must exist between low pressure process steam and power requirements. If this balance does not exist, the financial loss will be large. It is obviously uneconomical to generate all of the power required and use live steam through a reducing valve for process work. Whenever process steam is required, the non-condensing mechanical drive turbine serves the double functions of providing clean low pressure process steam and a source of mechanical energy. Steam is generated at the desired boiler pressure, the turbine directly transforming a portion of the heat energy to mechanical energy and delivering the unused balance of heat to the dryers at the desired pressure. The amount of heat in the steam which is converted into power is but a small percentage of the total heat available, hence power is produced at low cost and steam is supplied in the proper condition for use in the dryers.

Turbines require no internal lubrication, consequently the exhause steam is free from contaminating substances which would tend to coat the inside of the dryer shells with a heat resisting film, and thereby prevent the transmission of heat to the paper.

Mechanical drive turbines with reduction gears may be furnished for connection to one and of or in the middle of the line shaft. The turbine, reduction gear and governor are designed especially for paper mill service. Special long range governors permit the operation of the turbine over wide speed ranges. The governor is sensitive and accurate and may be arranged for remote speed control, "emergency-stop," etc.

The mechanical drive turbine requires but little installation space, and the cost of foundation is correspondingly small. The non-condensing steam turbine, with close speed

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regulation and providing clean steam for process work, is a very desirable drive for some classes of line shaft driven paper machines.

Direct Current Motors for Line Shaft Drive

Adjustable speed, direct current, single motor paper machine drives have been widely used. The choice between motor and turbine drives for a paper machine must be based on a detailed study of the overall economies of the drive with respect to speed range and tonnage made at various operating speeds. Generally speaking, for a wide range general purpose paper machine, the turbine drive will not prove economical, and an adjustable voltage direct current motor should be used to drive the line shaft, the power supply being obtained from a steam power balance motor-generator set.

This set is made up of a non-condensing turbine, reduction gear, synchronous machine, (synchronized with the plant alternating current power system), direct current adjustable voltage generator, and direct current exciter. The units are mounted on a common welded structural steel base and are connected together by means of suitable couplings. The synchronous machine floating on the line, acts as a speed governor for the turbine holding constant speed while the steam flow is controlled by a back pressure governor. Thus the amount of steam passed through the turbine is controlled by the demands of the dryer section. If more steam is required for drying than is needed by the turbine to carry the machine load, the excess power developed by the turbine is returned to the a-c. system by the synchronous machine which acts as a generator. If on the other hand, the demand for drying steam is less than that required by the turbine to carry the whole load, the deficiency in power is made up by the synchronous machine acting as a motor. This operation is entirely automatic, and since the steam demand from the dryer section is almost constant over the speed range, large amounts of energy may be returned to the alternating current system in case the machine is operating at slow speed where the power demand is low.

In case of a disturbance in the alternating current system, the synchronous machine is disconnected and with a magnetic transfer device, the turbine may be arranged to revert to its own speed governor, the back pressure governor becoming inoperative. The paper machine continues production uninterrupted, avoiding costly shut-downs and loss of time required to clean up the machine.

Generator voltage control, single motor, paper machine drives have been deservedly popular for many years.

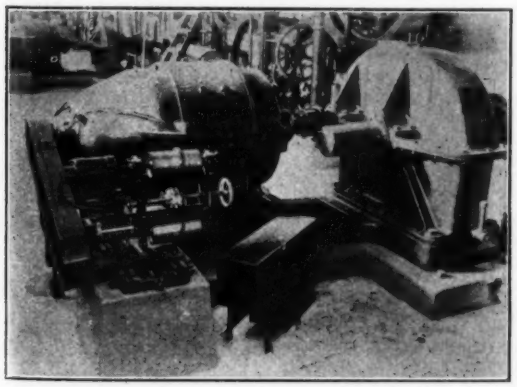

FIG. 1
Sectional drive unit—First drier section 190-inch paper machine showing enclosed ventilated motor, reduction gear and speed regulator transmitter unit.

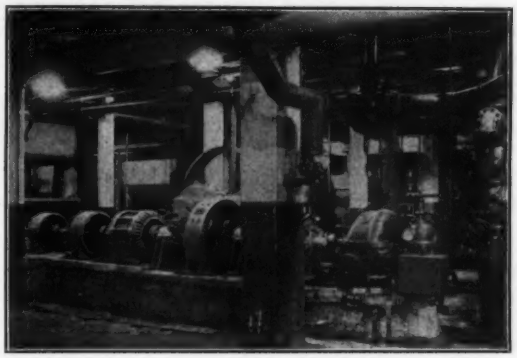

FIG. 2
Geared turbine generator steam balance set to supply power to sectional power machine drive.

Their economy, reliability, flexibility, and wide operating speed ranges are characteristics fitting admirably the requirements of paper machine drive.

Improvements have been made in the control and speed regulating equipment tending towards simplification, reliability and concentration of the control so that the operator may vary the speed of the machine by turning a rheostat handle and control the operations of starting and stopping the line shaft by means of push buttons.

The main driving motor may be direct connected to one end of the line shaft, or provided with a double shaft extension to fit into the line shaft. On small low speed machines, it may be desirable to use a moderate speed motor driving the line shaft through a belt, chain or gear reduction unit.

Speed Regulators for Single Motor Paper Machine Drive

The basic problem in the design of the speed regulator was to find an accurate, sensitive, but sturdy instrument to act as the main control element.

After a careful analysis of all the available types of instruments, it was decided that an instrument similar in principle to the contact making voltmeter would be most desirable. The device consists essentially of a large permanent magnet frame and a wound rotor, whose movement is restrained by a spring and suitable stops.

Mounted on the shaft of the rotor are two sets of opposed contact arms. Between these arms a center contact in the shape of a starwheel is rotated by a telechron motor. For a given value of voltage impressed across the rotor winding the torque produced is balanced against a spring. Should the voltage rise, the spring is overcome and this small movement of the rotor causes one of the contact arms to engage the rotating starwheel. Should the voltage decrease, the spring causes the rotor to move in the opposite direction, bringing the other contact arm into engagement with the starwheel. These contacts energize relays which control a motor operated rheostat in the field circuit of the motor or generator being regulated.

Thus the time of engagement of the contact arms and the rotating contact is minute for small movements of the torque element, but will be more nearly continuous for larger movements. This feature contributes to the stability necessary for successful operation, since for small corrections, the effect of one change of the generator field rheostat has time to register as a change in speed before further correction is made. In addition, because of the shape of the points on the starwheel, the magnitude of each correction applied is substantially proportional to the required correction. The mechanical reaction of the starwheel on the contact point tends to restore the torque element to the balanced position from which it is moved

only by a change in speed. The use of the rotating star-wheel contact provides in addition to stability, a freedom from contact trouble, since the wiping action keeps the contacts clean and provides for positive engagement.

The accuracy and sensitivity of this device are comparable to instrument standards, while the structural details compare more nearly to motor practice.

The wound rotor is energized from a separately excited pilot generator, chain driven from the back line shaft and especially designed so that variations in excitation have but slight effect on the generated voltage. This effect is constant for each generator and is compensated for in the design of the main control element by the addition of a compensating winding on the torque element, which is connected in a series with the pilot generator fields. The current direction in this winding is opposed to that in the main winding, and the strength is so proportioned that complete compensation is obtained for exciter voltage variation of 10% from normal. This feature makes it unnecessary to provide a voltage regulator for the main exciter, since normal variations in excitation voltage will not be detrimental to the operation of the drive. The elimination of the exciter voltage regulator simplifies the whole equipment.

The regulator is a static device, operating only when the speed of the main driving motor tends to vary. As such it may be cut into or out of service without shutting down the drive.

The speed regulator may be guaranteed to correct the speed of the driving motor to within one half of 1% plus or minus from a mean value.

The control provides overload and undervoltage protection, push button control, automatic acceleration to operating speed and preset speed control, that is, the drive may be operating at any speed, stopped and when restarted, will automatically accelerate to the previous operating speed.

Numerous drives have been furnished to operate over speed ranges of 10 and 12:1, using conventional equipment. Special drives can be furnished to provide speed ranges up to 30:1.

The single motor paper machine drive with a speed regulator is simple, reliable and easily controlled. A minimum amount of maintenance is required and under ordinary conditions the drive operates without direct supervision of the electrical department. Steam power balance generating equipment may be installed to provide a true heat balance or to meet unusual operating conditions.

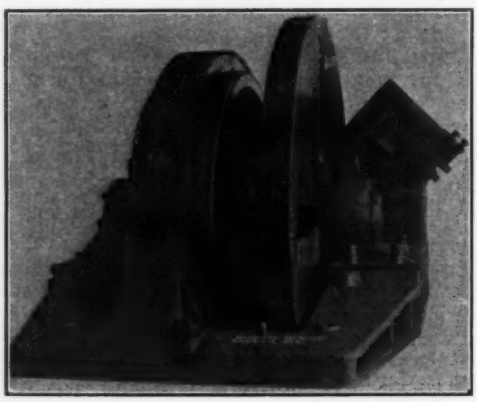

FIG. 3

200 hp., 257 r.p.m. synchronous motor, direct connected to 96-inch chipper.

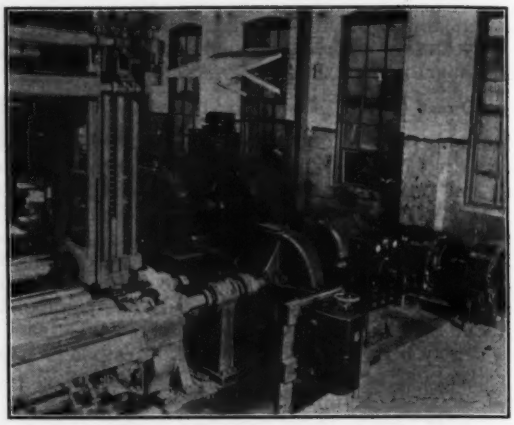

FIG. 4

Adjustable voltage 2000 f.p.m. winder drive with regenerative braking tension control.

Wet End Drive for Cylinder Machines

Many motorized wet ends for cylinder machines have been installed in the last few years. Saving in felt costs and an improved product have thoroughly demonstrated the value of the equipment. Individual drives for the cylinders and suction rolls, will effect material savings in felt cost and through the elimination of the mechanical load, permit the felt to be woven for better water removal, which should be its primary function. The sheet made will be improved, due to a decrease in the total stretch of the felt and the lessened tendency of the layers to pull apart. A further possibility is the application of individual drive to weighted top rolls, thus avoiding the transmission of the power required to turn the top rolls through the sheet of paper, eliminating complicated mechanical devices for obtaining the same results.

This wet end drive may be applied to existing board machines, whether sectional or line shaft driven, regardless of the prime mover. The control is so arranged that all of the motors exert their proper proportion of starting torque, avoiding undue strains on the felt. The operators may adjust the loads on individual motors as desired.

Constant Tension Winder Drives

Constant tension winding equipment has been developed and is generally applicable to winders which normally require 50 KW or more. The equipment has three outstanding advantages:

(a) Troublesome mechanical brakes on the unwinding stand are eliminated.

(b) The rolls produced on the winder are more uniformly wound.

(c) A power saving of from 10% to 60% may be effected, depending on the class of paper being wound.

The equipment may be arranged to put an initial tension in the sheet and maintain this tension during acceleration to winding speed. Provision is also made for running the braking generator as a motor to facilitate threading up the winder.

Super-Calender Drives

There are two modern types of alternating current super-calender drives—the double motor drive and the dual frequency drive.

The double motor drive is particularly suited for use where a single super-calender is to be driven. Where a battery of three or more super-calenders is involved, the

dual frequency type of drive will usually prove to be more economical.

The double motor drive is designed to occupy minimum floor space in the mill. The main driving motors is of the wound rotor adjustable speed induction type connected to the bottom roll of the calender stack through a herringbone reduction gear and suitable flexible couplings. The speed of the main motor may be adjusted over a 2:1 speed range by means of a drum controller and secondary resistor. Suitable threading speed is obtained by means of a small constant speed induction type gearmotor connected to the main motor through an enclosed chain drive and a pawl type over-running clutch.

Two step acceleration of the constant speed motor to threading speed reduces the shocks to which the calender is subjected. Semi-automatic control is standard and the transition from threading to minimum calendering speed is accomplished smoothly and gradually. The calender may be brought to a quick stop when desired by plugging the main motor. Push buttons are provided to start, jog, thread, brake and stop the super-calender. The control provides overload and undervoltage protection.

The dual frequency drive is based on the principle that a wound rotor induction motor will operate at a speed approximately in proportion to the frequency of the power supply. Thus, by using a single wound rotor induction motor to drive the super-calender and providing a power supply, of the proper frequency to operate the main driving motor at the desired threading speed, a drive has been developed which requires minimum floor space, has the simplest mechanical construction and which is economical in first cost and in operation.

The low-frequency generator is entirely independent electrically of the mill power supply as it is self-excited. It is driven by a standard squirrel-cage induction motor arranged for operation from a power supply of any commercial voltage or frequency. This low-frequency generator is usually designed to be of sufficient size to operate several super-calenders while threading. In this way, a low-frequency power bus is available for operating the main wound-rotor induction motor while threading, and the mill power supply is utilized for operating the same motor while calendering. Adjustment of the calendering speed is accomplished by adjusting the secondary resistor of the driving motor.

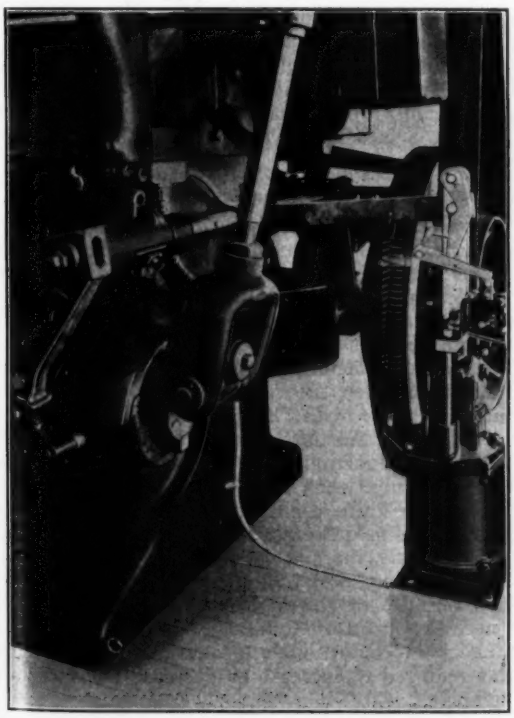

FIG. 5
Thrustor and control for operating guillotine paper cutter.

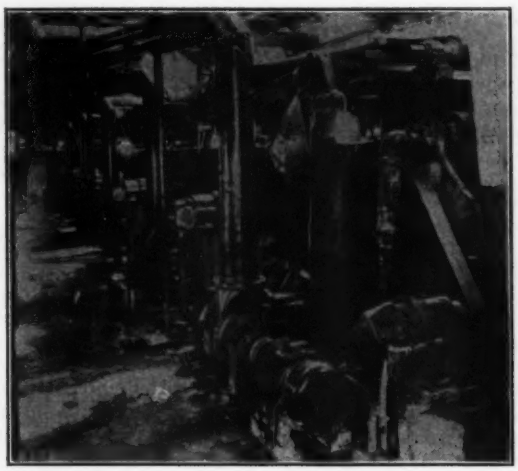

FIG. 6
Gearmotors driving cylinder molds of 124-inch, 500 foot per minute cylinder machine.

In the modern dual-frequency drive, as in the two-motor super-calender drive, the motor drives the bottom roll of the calender through a totally enclosed, self-lubricated, herringbone reduction gear unit. The motor is connected to the gear, and the gear to the super-calender, by means of flexible couplings, thus minimizing the problem of mechanical alignment.

Semi-automatic control of the dual frequency drive provides two-step acceleration to threading speed and smooth transition from threading to minimum calendering speed. Push buttons are provided to start, jog, thread, brake and stop the super-calender.

The entire operation of the super-calender during threading, acceleration and calendering is accomplished by means of a single hand-operated, drum controller.

Direct current equipments providing the same desirable features of operation and simplicity of control are available where desired.

The constant tension winder equipments may be applied to both the winding and unwinding stands of super-calenders with the advantages as mentioned for winders.

Gearmotors

Many machines operate at low speed, whereas the most desirable motor speeds are from 900 to 1800 r.p.m. Gearmotors, alternating or direct current, fill a long felt need for a quiet, compact and efficient driving unit. A wide range of output shaft speeds and horsepower ratings are available. The motors may be of open, enclosed, fan-cooled, splash-proof, or enclosed pipe ventilated type construction. The cutaway photograph shows the typical construction of the open motor.

The gearmotor has many applications. Typical applications are screens, plunger pumps, fan pumps, agitators, conveyors of all cases, whippers, individual roll drives for board machines, etc. In the paper mill, converting plant and power plant, many troublesome drives may be replaced by gearmotors.

Synchronous Motors

Aside from the usual applications of synchronous motors in paper mills, such as on motor generator sets, centrifugal pumps, fans, pulp grinders, jordans, centrifugal screens, vacuum pumps, etc., synchronous motors are now being applied to beaters, chippers, shredders, and wood hogs.

Synchronous motors may be used to increase the efficiency and power factor of the plant, to increase the capacity and reduce copper losses in feeders, and also have the important advantage of operating at a precise speed.

An interesting synchronous motor application is a 200 h.p., .9 p.f. unit, direct connected to a 96-inch chipper. Means are provided for adjusting the depth of the cut by an endwise adjustment of the rotor of the synchronous motor.

Modern synchronous motor control equipment provides positive protection not only to the stator but to the amortisseur winding of the unit in case the motor pulls out of step or stalls, due to a dip in the line voltage or to excessive load. This control equipment is particularly valuable for grinder motors, Jordan motors, and chipper or shredder motors which may be subjected to very high peak overload. In case the units become jammed or stalled, and an attempt is made to start them without removing the cause of trouble, the motors will not be injured. These protective relays may be added to existing control panels.

Thrustors

The thrustor produces a straight line, constant pressure thrust from an electric motor drive. There are two general fields of application:

(1) To supply pressure and actuate lever mechanisms.

(2) To replace muscular effort with electric control on foot or hand-operated machines. The thrustor, which can be remotely controlled from one or more points by means of push button stations may be used to replace air cylinders and complicated mechanical lever systems.

Thrustors are being used to open doors, operate clutches, brakes and valves.

The mechanical construction of the thrustor may be modified to permit time delay during the power or return stroke and variable thrusts during the power stroke.

FIG. 7
Photoelectric cut-off register control installed on paper bag tuber.

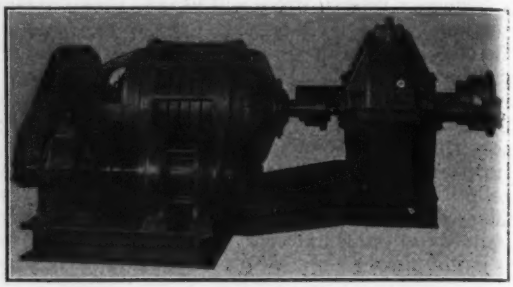

FIG. 8
Double motor, alternating current, supercalender driving unit.

Special dust-tight (intermittent rated) designs as well as special insulations for high ambient temperatures are available.

Thrustors controlled by definite time relays will operate on predetermined duty cycles. The driving motor may be repeatedly energized at short intervals to give a number of strokes per minute.

Selsyn Devices

The Selsyn or self-synchronous motor, consists of a stator similar to that of a 3-phase induction motor, and a salient pole rotor, the windings of which are connected through slip rings to a source of single phase, alternating current excitation.

Some of the many applications are indications of liquid levels in tanks, the position of gates or valves, recording changes in liquid levels, steam, gas or oil pressures. Selsyn units operate compression rheostats, provide remote sectional paper machine drives.

Power Selsyn units may be used where large torques are required to operate valves or separate sections of a machine in exact synchronism. This type of Selsyn unit may be used to synchronize one or more separate driving motors or to drive the machine directly.

Selsyn units have a wide field of application in paper mills, and will solve practically any problem of remote signalling, control or indication. In connection with other devices, the Selsyn units will not only indicate, but record various operations.

Vacuum Tubes

Photoelectric equipment applied to packaging machines, perforators, wrapping machines and paper bag tubers maintains the register between the cutting operation and the printed matter on the surface of the paper. At the time the printing is put on the paper, a spot is printed in the margin and this spot passes before a photoelectric tube mounted on the machine. As long as the spot passes before the tube when the cutter is in the proper position to cut in register with the printing (as determined by a selector disc on the cutter shaft), the photoelectric equipment does not function. If the spot appears before the photoelectric tube when the paper is not in synchronism with the cutter knife, a circuit is energized which momentarily increases or decreases the speed of the cutter knife.

By this means, the cutting operation is kept in register with the printing, despite slippage and stretching of the paper. Because of the high linear speed of the paper, it is necessary to use Thyratron tubes to respond to the amplified photoelectric impulse and energize the magnetic devices required to increase or decrease the speed of the cutter knife.

Formerly the machines ran at comparatively slow speeds and an attendant continuously changed the speed of the machine through a manual compensator to correct the

errors caused by humidity, slippage and stretching of the sheet.

The photoelectric control equipment will permit the machines to run at speeds up to 500 feet per minute on some classes of papers with accurate control of the cut and the elimination of manual supervision. A number of equipments are in operation on flour, coffee and cement bag tubers, wrapping machines, perforating and stamp machines, and gum wrappers, handling all classes of papers, including tissue and cellophane.

Photoelectric equipments are used as smoke detectors in power houses, as web break detectors on winders, to turn on signs and control lights in offices, as counters for small articles and in connection with other devices as door openers. They can be used as web break detectors and to control edge alignment on paper machines.

Guillotine Paper Cutters

While this type of cutter is extensively used in the converting plant, the fundamental design of the machine is such that the operators should be fully protected against accidental engagement of the operating mechanism or repeat strokes. Various mechanical devices have been used to protect the operators and safety codes specify that the operator must use at least one hand to engage the controlling mechanism so as to reduce the possibility of injury likely to result from operating the cutter on an automatic cycle.

Thrustors and push buttons are now used to control the cutter. The thrustor engages the clutch mechanism and two momentary contact push buttons control the thrustor so that the operator must use both hands, thus minimizing the possibility of injury. Suitable interlocking prevents repetitive strokes. The control may be jogged for very short distances as required in setting up a new knife.

The thrustor and control thus relieves the operator of the muscular effort of operating the clutch as well as eliminating the hazards of operation.

Air Circuit Breakers

Many paper mills use large blocks of power at low voltages. Large air circuit breakers are being used extensively to control this power. These breakers are available in sizes up to 5,000 amperes, triple pole, 600 volts a.c.

A line of smaller metal enclosed air circuit breakers has been developed in capacities up to 200 amperes—480 volts alternationg current. The switches are manually operated, trip free and provide overload and short circuit protection to the circuit controlled. These switches can be furnished in single, double, triple and four pole arrangements.

These metal enclosed breakers are operated by a handle projecting through the door of the switch and can be installed to provide a dead front switchboard in a minimum of space.

The many advantages of electrical apparatus in the pulp and paper industry have been thoroughly demonstrated over a period of many years. The equipment is flexible, economical and reliable. Maintenance expense is low. Electricity will, in the future, as in the past, play a vital part in the solution of the many problems facing a progressive industry.

Power Possibilities in the Northwest

By C. C. Hockley[1]

There seems to be a tendency to indulge in superlatives about our climate, especially by our brothers south of Oregon, and climate certainly should be considered when the use of power is under discussion. May we dismiss the matter of climate with just one statement? We have here a temperate climate, which reduces costs for housing and heating, and last winter we did not have one flake of snow in Portland. The pleasures of winter we get by driving fifty miles on perfect roads to the mountains, where at high elevation snow remains all year, and where winter sports are featured.

It seems strange that the Rocky Mountains seem to have established an "unknown isle" about 1,000 miles wide and extending some 2200 miles along our west coast from Canada to Mexico. This territory is unknown, or at least unfamiliar to many, due to distance from our homes. But this feeling is changing rapidly, and we now step into a plane in Chicago at 2:30 a.m. and at five o'clock the same day we are in Portland. Transportation has brought our East and West Coasts, 3,000 miles apart, within one day's travel, and has enabled the west to properly claim its share of our entire country's business.

Probably our country's progress has been due more to improvements in transportation and use of power than to any other factors, and we feel that with the raw material available and reproduceable on the West Coast, and our water powers developed and protected, that we face an enormous development during the next twenty-five years. It is not remote, we will all see it.

The hydro-electric powers and their development in the West (not Minnesota and Iowa) are so spectacular that their description often raises doubts in your mind as to the veracity of the speaker.

We have high head developments, for example, the lake developments of Alaska where lakes on the plateau almost overlooking the sea, giving single heads of up to 3,000 feet, and cheap power in the midst of the world's most beautiful scenery.

We have the turbulent rivers, dashing from the coast range to the Pacific with total heads, to be developed (as are the Umpqua, Rogue, McKenzie and Lewis Rivers) in several plants of varying heads.

You may not be familiar with the Deschutes River, a wonderful power stream flowing north to the Columbia River, through a canyon in places 3,500 feet deep. This is a spring fed and snow fed stream, only 100 miles from Portland, which, due to its unusual source only varies from a minimum flow of 5,000 c.f.s. to a maximum of 30,000 c.f.s., and in its 140 miles above its mouth has a total head of 1800, and carefully estimated firm power available in the several sites of 450,000 k.w.

Columbia River Developments

The eyes of the nation are centered at present upon the Columbia River developments, and perhaps you would be interested in a shirt description of this stream and its possibilities.

* Presented at the fall meeting of the Technical Association of the Pulp and Paper Industry, Portland, Ore., Sept. 10 to 13, 1934.

[1] State Engineer for Oregon, Public Works Administration, Portland, Ore.

Rising in Canada in Columbia and Windermere Lakes, the Columbia flows north and west to the Big Bend, and then south into the State of Washington, where it turns west and then south to the Oregon line, from which part of it flows west to Portland and the Pacific Ocean, forming the Oregon-Washington state's lines.

At the point where the river runs west in Washington, it has left what was apparently its old river bed, which continued south. This old bed will probably form the reservoir into which the water will be pumped by Grand Coulee power, and from which about 2,000,000 acres of land may at some time be irrigated. With a watershed of 259,000 square miles, the Columbia River is 1200 miles long, and we find 750 miles are in the United States. On this 750 miles probably the finest power possibilities in the world exist.

Beginning at tidewater with Bonneville Dam, 140 miles from the river mouth, we find a total of eleven natural sites in the United States, on which 3,685,000 firm power can be developed at very low cost. Final figures are not available, but with load factor varying from 50 to 80 per cent, costs will be apparently 1.4 mills to 2.0 mills at the plant, and could be delivered at Portland or Seattle at 2.0 to 2.4 mills per k.w.h.

The problems in the development of such a stream cover the full range with all their difficulties, and we find two P.W.A. projects now wrestling with them.

With a stream where flow varies from 40,000 c.f.s. to 1,250,000 c.f.s., new problems arise, and being in a district of volcanic rock, adds to the interests.

The Grand Coulee Dam

The Grand Coulee Dam has already an appropriation of $62,000,000 for its construction at a site where, backing the water 150 miles to the Canadian border, 775,000 firm h.p. can be developed with its 350 feet head.

The Bonneville Dam with an appropriation of 31 million dollars will be located at tidewater, and with a head of 72 feet will be built to house ten 67,000 h.p. units of the vertical type, and having adjustable runners. This plant will develop 320,000 firm h.p.

You may well be interested, because you as citizens are paying 30 per cent of the cost of material and labor on these big hydro-electric plants.

The fishing industry, being one of the great industries centering on the Columbia River, the Army engineers have spent some sleepless nights trying to figure some sure way to pass the silver horde up and down the stream. They have tried elevators and ladders. They hoped to develop a wheel runner, which would allow the small fish to pass down stream unharmed. Sportsmen have advised; commercial fishermen have threatened; and everyone from the fireman to the clergyman has made suggestions, but the final solution is still to come, and probably it will come at a cost of two to three million dollars.

As this is a navigable river, tapping our great wheat district, canals and deep sea locks will take our seagoing vessels one hundred miles inland to allow wheat to be loaded for delivery to Japan, Europe, etc. These locks will be the one lift type.

While the power is here, and is being developed, we cannot look ahead to its use.

Intensive surveys have been made by Army engineers and industrial engineers, and we know that power use depends upon three things in particular: transportation, raw material, and population.

1st: Transportation: In this particular, we can bring foreign or domestic raw material to a tidewater power plant, and with little or no transmission of energy, we can manufacture it and from the factory door, ship it to the Seven Seas.

2nd: Raw Material in the shape of timber and minerals lies at our doors with pulp wood as a headliner, and lime phosphorous rock and the chemical industry to round out the picture. Aluminum can be brought to the plant from foreign shores, and apparently the lowest priced power in the world should find complete use.

3rd: Population is small and our growth will follow the development of industries.

Economists estimate a population west of the Rocky Mountains in 1950 of 20,000,000, with 3,200,000 in Washington; 1,800,000 in Oregon, and 9,200,000 in California.

This would indicate a need in the Northwest (still not Minnesota or Iowa) of about four million to five million k.w. or an addition to our present hydro-electric plants of about 2,500,000 to 3,500,000 k.w.

We offer to the paper business everything it needs from climate to power and raw materials, with the exception of concentrated markets, and we suggest that with rail and water transportation as it now is, that the Northwest cannot fail eventually to be our pulp and paper manufacturing center.

Power Statistics

The following table by the Northwest Electric Light and Power Association gives some interesting facts about Oregon, and you will note that of the 93,750 square miles only 8 per cent or 7,500 square miles, are served, and that 100,000 of the population are not served.

I call your attention to the opportunities offered in these enormous areas with their timber and other natural resources and their, as yet, small population.

In considering this Northwest, we have to remember that, although so much of our potential power is undeveloped, we have efficient private developments established, and with capacity to care for any immediate needs.

OREGON POWER DATA—1934

Area, square miles	93,750
Area served—8 per cent	7,500
Total population	953,000
Rural population	367,000
Population served	853,000
Incorporated towns—number	204
Incorporated towns—population	587,000
Incorporated towns—served	186
Incorporated towns—population served	585,122
Unincorporated towns—number (P.O.)	553
Unincorporated towns—population	57,550
Rural served—population	211,550
Total population served	814,000
High tension lines—miles	2,043
Rural lines	5,055

The West Coast has one third of the potential water power of the entire U. S. A., which has 40,000,000 h.p., of which 12 million is developed.

Washington has 7,145,000 h.p. of which 1 million is developed.

Oregon has 3,700,000 h.p. of which 370,000 is developed.

California has 4,600,000 h.p. of which 2,447,000 is developed.

It would seem that, with one third of the hydro-electric power of the United States on the West Coast, industry will seek it out. Coal and labor going up makes the water powers more attractive, and we hope that you will join us in the job of developing and using our water powers.

If you do not care to develop your own power, we hope you will decide to manufacture here, and use the cheapest power in the world, which Uncle Sam is now developing.

May I thank you for the opportunity of telling you briefly about our Northwest and its power possibilities.

The Pulping of Douglas Fir By Ammonia Base Liquor*

By H. K. Benson[1], R. P. Erwin[1], J. R. Hendrickson[1], and J. A. Tershin[1]

Abstract

A series of experimental cooks in ammonia base liquor were made with a mixture of commercial spruce and hemlock chips, with old Douglas fir chips, with young Douglas fir chips, and with Douglas fir chips which had been previously treated with a five per cent solution of ammonia at a temperature below 70 deg. C.

In evaluating these experimental pulps it was found that young Douglas fir closely parallels the commercial spruce and hemlock; that pretreated Douglas fir approaches spruce and hemlock; and that pulps made of old Douglas fir are of a distinctly lower order of quality.

The dominant species of timber in the Pacific Northwest is Douglas fir. Aside from its limited use in conjunction with other pulp woods in the soda and sulphate processes it serves mainly as a fuel in the making of pulp by the sulphite process. When cooked by a lime base acid it yields a pulp characterized by a large amount of screenings and uncooked chips and has a high bleachability. When such a pulp reaches the machine wire it becomes clogged and sheet formation is greatly hindered and often impossible. It is generally believed that its high resin content is the cause of these unfavorable characteristics.

In this study an attempt has been made to ascertain the effect of the removal of the resin by pretreatment with ammonia and the subsequent cooking of the extracted chips with acid sulphite containing an ammonia base in place of the customary lime base.

Description of Experimental Procedure

The experimental equipment in the chemical engineering laboratory of the University of Washington has been previously described *(1)*. Unless otherwise specified the standard TAPPI methods were employed for pulp evaluation. The sulphur dioxide was supplied from tanks as was the ammonia. The latter was bubbled into water to the calculated concentration whereupon SO_2 was turned in and the cooking liquor built up to the proper composition which in general was as follows:

	Per cent
Free SO_2	3.5
Combined SO_2	1.3
Total SO_2	4.8

The cooking curve was selected from Miller and Swanson *(2)* and is given in Fig. 1. It varies from the ordinary procedure in that the maximum temperature was reached very late in the cook, on the principle that a low average temperature in the time available will give the most satisfactory results. The maximum temperature was higher for the low free SO_2 concentrations and lower for the high free SO_2 liquors.

Since pressure is a secondary factor in cooking little attention was paid to it since relief with this particular digester is somewhat tedious. It was relieved only to keep the pressure in the region of 90 to 100 pounds per square inch. At the end of the cook the pressure was relieved, the digester opened and hot water added to the contents. Then the contents were poured into pails and the pulp centrifuged. It was next screened in the Valley vibrating screen. The undisintegrated chips retained were run in the beater with no weight on the arm and this pulp rescreened, the material retained being called screenings. The screened pulp was again centrifuged and dried to constant weight at 80 to 90 deg. C. in a steam heated pulp drying oven. The weight of the oven-dry pulp divided by the weight of oven-dry chips used multiplied by 100 was the figure used for the percentage yield.

Types of Chips Used

For comparative purposes the first cooks were made on commercial spruce and hemlock chips obtained from a local pulp mill. Similarly Douglas fir chips were especially cut through the courtesy of a local mill. Chips were made from young Douglas fir trees grown in Mason County by sawing them into blocks of uniform length and reduced to chips by hand splitting. The young Douglas fir was from trees 14-16 feet in height and 2½ to 3 inches diameter and contained no heart wood.

Pretreatment for Rosin Extraction

The pretreatment of Douglas fir chips consisted of preheating the chips in a 5 per cent solution of ammonia, about 10 liters of this solution being used for 2000 grams of oven-dry wood or a ratio of 5 to 1 in terms of the dilute solution. Previous work *(3)* has shown that the optimum temperature for resin removal from commercial chips by 5 per cent ammonia is 70 deg. C., and in a pressure bottle, with no agitation, extraction of about 95 per cent can be effected. Above this point the ammonium resinate tends to break down into resin and ammonia again, so that higher temperatures are not suitable for resin extraction *(4)*. The pretreatment was carried out in the KA-4 digester. It was rotated and the temperature brought up to 70 deg. C. in half an hour. Then the heat was turned off and the digester allowed to cool down for an hour. At the end of this period the ammonia liquor was drained off yielding a liquid of a distinctly dark brown color. The digester was filled with water, closed and rotated for a half hour, drained and the washing operation repeated.

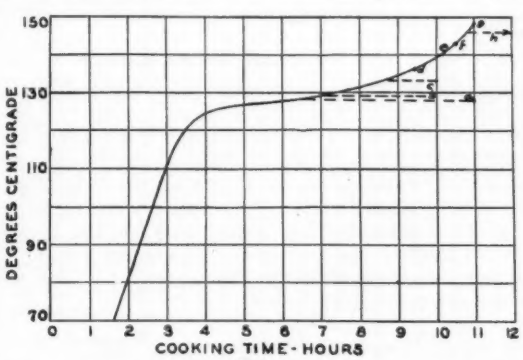

FIG. 1

Cook Nos.: a-27; b-31; c-19 and 20; d-16; 18, 21, 22 and 29; e-8 and 9; f-10; g-5 and 13; h-1 (12¾ hours).

* Presented at the fall meeting of the Technical Association of the Pulp and Paper Industry, Portland, Ore., Sept. 10 to 13, 1934.

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A summary of pretreatments made for cooks 11, 13, and 14 shows the following ammonia balance:

Cook No.	Ammonia introduced, grams	Ammonia remaining in chips (grams): After liquor removal	After first washings	After second washing
11	570	175	66	41.6
13	849	180	85.4	63.7
14	534	150	58	39.0

It was found, however, that satisfactory pulp may also be obtained by a shorter method of washing the chips twice in a centrifuge as was done in Cook 16. Variations in the temperature and time of contact of the ammonia solution were made for the purpose of obtaining a more complete extraction of the resin. These conditions were as follows:

Cook No.	Maximum Temperature, Deg. C.	Time held at Maximum Temperature, hours
23	115	3
24	104	3
25	75–80	3

In each of these cases the chips were of a much darker color after pretreatment than in the first series, though the chips in cook 25 were lighter than in 23 and 24. None of these cooks showed signs of cooking into pulp after the required sulphite cooking. Nothing but brown chips with mealy pieces of amorphous material between the layers of wood fiber of the chips was obtained.

For the purpose of ascertaining if temperature only was responsible for the non-pulping of these chips, water alone was used in cook 30, the other conditions being similar to those in cooks 23 and 24, with a maximum temperature of 102 deg. C. These chips were light colored and when cooked by the sulphite process gave a pulp which was of the same type as the pulp obtained from unpretreated old Douglas fir.

It is evident from these results that at higher temperatures and longer periods of contact, the chemical action of ammonia is responsible for the change in the cooking properties of pretreated Douglas fir with respect to the sulphite process using ammonia base cooking liquor. It is further concluded that in order to cook pretreated chips only strict limits as regards time and temperature of pretreatment can be permitted. The maximum temperature should not exceed 70 deg. C. and the time at this maximum temperature should be very short, followed by immediate cooling and the removal of the soluble ammonium extracts by thorough washing in centrifuges or diffusion batteries.

Experimental Results

The total number of cooks made in the study was 32. Due to the variable factors involved in the temperature, acid strength, and species, many of the cooks did not result in the production of pulp. A full list of cooks is given in Table I.

Discussion of Physical Testing Methods

Owing to the small quantity of pulp, about 700 grams per cook, the standard method of beating could not be followed. 180 grams of pulp were taken and enough water to make 13.5 kilograms were added to the beater, run 5 minutes for disintegration and then a weight of 8636 grams placed on the beater arm. Two sheets were made from each sample: one series for Mullen tests and the second at maximum Mullen was torn in the Elmendorf tester. The pulps may be arranged in the following order with reference to these two tests:

Mullen	Elmendorf
Young Douglas fir	Young Douglas fir
Hemlock and spruce	Hemlock and spruce
Pretreated Douglas fir	Douglas fir
Douglas fir	Pretreated Douglas fir

TABLE I.—COOKING DATA

Cook No.	Chips	Combined SO_2	Free SO_2	Total SO_2	Max. Temp. Deg. C.	Time Hours	Results
1	Hemlock and Spruce	1.30	1.90	3.20	146.1	12¾	Pulp tested
2	"	1.38	3.14	4.52	144.	10	Overcook
3	"	1.30	2.20	3.5	....	9	Undercook
4	"	1.30	2.82	4.12	145.5	10	Overcook
5	"	1.30	2.80	4.10	148.3	11	Pulp tested
6	"	1.30	2.82	4.12	147.7	11	Overcook
7	"	1.28	3.34	4.62	140.5	11	Overcook
8	"	1.28	3.34	4.62	140	10	Pulp tested
9	Douglas fir...	1.30	3.10	4.40	139.4	10	Pulp tested
10	Pretreated Douglas fir	1.30	3.10	4.40	142.8	10½	Pulp tested
11	"	1.28	3.34	4.62	147.7	10¾	Overcook
12	"	1.30	3.10	4.40	135	2	Cook discontin'd
13	"	0.85	2.49	3.34	147.8	10½	Tested pulp
14	"	0.22	1.44	1.66	147.8	11	Undercook; attempted to form combined SO_2 remaining in chips
15	"	1.09	2.55	3.64	145.5	10½	Undercook
16	"	1.23	4.07	5.30	136.1	9½	Tested pulp
17	Hemlock and Spruce	1.08	4.08	5.16	135	9½	Overcook
18	"	1.08	4.08	5.16	136.1	9½	Tested pulp
19	"	1.08	4.08	5.16	133.3	8½	Tested pulp
20	"	1.10	4.10	5.20	133.9	10	Tested pulp
21	Douglas fir...	1.10	4.10	5.20	136.7	8½	Tested pulp
22	"	1.10	4.10	5.20	135.6	9½	Tested pulp
23	Pretreated Douglas fir	2.25	3.20	5.45	137.8	8	Brown chips; pretreatment temp. too high.
24	"	2.25	3.20	5.45	138.3	9	Brown chips; pretreatment temp. too high.
25	"	2.2	3.0	5.2	137.8	8½	Brown chips; pretreatment at 80 deg. C. for 3 hours.
26	"	1.24	5.70	6.94	129.4	7½	Undercook
27	"	1.40	4.90	6.30	127.8	11	Tested pulp
28	Young Douglas fir	1.40	4.90	6.30	133.3	9	Overcook
29	"	1.30	4.22	5.52	136.1	9.5	Tested pulp
30	Douglas fir...	1.40	4.90	6.30	....	....	Pulp not tested. Pretreatment with water at 80 deg. C.
31	Young Douglas fir	1.30	4.22	5.52	128.9	9.75	Tested pulp
32	"	1.40	4.90	6.30	127.8	10	Overcooked

TABLE II.—PHYSICAL TESTS OF HEMLOCK AND SPRUCE PULP

Cook No.	Yield Per cent	Screenings Per cent	Moisture in Chips Per cent	Mullen Per cent Pop	Time to Max. Mullen Minutes	Tear at Max. Mullen Per cent tear
1	30	1.25	9.2	56.1	70	88.0
5	40	0.08	45.0	49.7	50	114.0
8	...	...	9.0	64.8	90	265
18	36.7	...	59.4	93.5	80	242
19	41.7	...	59.4	39.2	40	105
20	38.6	...	59.4	95.0	60	190

TABLE III.—PHYSICAL TESTS OF DOUGLAS FIR PULPS

Cook No.	Yield Per cent	Screenings Per cent	Moisture in Chips Per cent	Mullen Per cent Pop	Time to Max. Mullen Minutes	Tear at Max. Mullen Per cent Tear	Remarks
9	36.0	1.4	9.0	52.7	50	119	
21	45.5	...	25.6	55.4	80	91	
22	38.2	1.85	25.6	43.3	80	86.2	
27	39.7	...	26.8	49.4	50	70.6	
10	36.8	4.3	31.0	62.8	90	64.2	Pretreated
13	37.0	2.4	31.0	63.2	70	89.8	Pretreated
16	41.4	0.67	20.0	69.0	60	105.2	Pretreated
29	35.6	...	32.2	102	60	177	Young trees
31	39.6	1.7	32.3	96	70	194	Young trees

Since the consistency of the stock and the volume of the material are less than in the standard method the beating time is only of relative significance. From the general physical characteristics of the pulps examined it is safe to say that the young fir makes the strongest and toughest paper of the series. Pretreated Douglas fir is about the same as hemlock and spruce while Douglas fir is the least strong.

Discussion of Chemical Tests

The standard Sohxlet extraction method was used to determine the resin content. Based on the ether extraction, the species increase in resin content in the following order: pretreated Douglas fir, young fir, hemlock and spruce and Douglas fir. It is apparent, therefore, that resin extraction of chips need not be complete but only to the extent that makes its content comparable to other coniferous pulp

TABLE IV.—CHEMICAL TESTS OF HEMLOCK AND SPRUCE PULPS

Cook No.	Ether Extraction, Per cent	Alcohol Extraction Per cent	Total Resin, Per cent	Lignin, Per cent	Alpha Cellulose, Per cent	Bleachability: $KMnO_4$ Number	Bleachability: Chlorine Number	Bleachability: 35 Per cent Bleach (Cl x 2.86)	Copper Number
1	1.18	2.12	3.30	4.83	88.98	9.80	4.64	13.30	4.43
5	0.65	3.06	3.71	5.35	93.00	6.33	2.91	8.33	2.89
8	0.60	0.88	1.48	4.65	90.37	9.82	4.65	13.31	3.10
18	0.82	0.88	1.70	4.52	89.93	7.42	3.44	9.85	2.96
19	0.66	0.77	1.43	3.99	91.80	8.97	4.22	12.08	2.78
20	0.40	1.28	1.68	4.47	89.67	12.53	6.09	17.44	2.99

TABLE V.—CHEMICAL TESTS OF DOUGLAS FIR PULPS

Cook No.	Ether Extraction, Per cent	Alcohol Extraction Per cent	Total Resin, Per cent	Lignin, Per cent	Alpha Cellulose, Per cent	Bleachability: $KMnO_4$ Number	Bleachability: Chlorine Number	Bleachability: 35 Per cent Bleach (Cl x 2.86)	Copper Number
9	1.76	2.52	4.28	6.72	87.50	10.78	5.14	14.72	4.97
21	1.10	0.97	2.07	5.27	94.20	38.80	25.85	73.0	10.40
22	1.57	2.05	3.62	5.78	91.23	27.50	15.85	45.4	8.76
27	1.42	2.69	4.11	6.34	89.28	28.35	16.56	47.4	6.77
10	0.47	0.60	1.07	5.48	87.83	18.85	9.83	28.2	3.58
13	0.50	1.02	1.52	4.96	92.10	16.95	8.67	24.8	5.06
16	0.62	1.25	1.87	5.61	90.55	14.14	6.97	19.98	3.94
29	0.64	1.23	1.87	2.49	91.57	11.96	5.79	16.58	3.54
31	1.00	1.36	2.36	3.11	90.00	12.20	5.92	16.95	3.05

woods that function properly in paper making operations.

The high values obtained by the standard alpha cellulose method confirm the results previously obtained by Moulton and Ziegler *(5)* showing that ammonium bisulphite cooking of hemlock gives a general increase in alpha cellulose ranging in values from 86 to 93 per cent. From a comparative study of hemlock cooking, Moulton and Ziegler concluded that the degradation products of calcium base cooking are soluble in an ammonium bisulphite cooking liquor. This would account for both the lower pulp yields and the higher alpha cellulose values.

The copper number was determined by the Forest Products Laboratory method. The high values for Douglas fir were checked and confirmed. The average values obtained for the different woods are as follows:

Hemlock and spruce	3.19
Young Douglas fir	3.29
Pretreated Douglas fir	4.19
Douglas fir	7.72

The method employed for the lignin determination is the modification proposed by Noll in which dimethyl aniline is used as a protective agent *(6)*. These values in general are lowest for young Douglas fir and highest for Douglas fir. Pretreated Douglas fir is slightly higher than hemlock and spruce. If, however, the total resin plus the lignin be compared it will be found that the pretreated Douglas fir is lower in these impurities than hemlock and spruce. The very low lignin content of the young Douglas fir pulp makes it available for uses dependent upon high purity.

In order to determine the purifying effect of the ammonium bisulphite cooking liquor, determinations of resin content and of lignin were also made on the chips used in the various types of cooks made. These are given in Table VI.

TABLE VI—COMPARISON OF RESIN AND LIGNIN CONTENT IN WOOD AND THE RESULTING PULP

	Hemlock and Spruce		Pretreated Douglas Fir		Douglas Fir		Young Douglas Fir	
	Wood	Pulp	Wood	Pulp	Wood	Pulp	Wood	Pulp
Ether extract	6.52	0.72	1.72	0.48	9.98	1.46	5.34	0.84
Alcohol extract ...	0.00	1.49	2.18	0.82	15.15	2.05	3.66	1.29
Total resin	6.52	2.21	3.90	1.30	25.13	3.51	15.15	2.13
Lignin	...	4.63	....	5.35	....	5.92	....	2.80

In the determination of bleachability, the proposed method of R. H. Wiles *(7)* of the TAPPI Pulp Testing Committee was used. In this method the permanganate number is by definition the number of cubic centimeters of one tenth normal potassium permanganate solution which is absorbed by one gram of the oven dry pulp under specified conditions. The permanganate number may in turn be converted to the chlorine number which is the number of grams of chlorine in the form of calcium hypochlorite solution necessary to bleach 100 grams of the oven dry pulp to a good commercial white in a single stage operation.

As is well known, Douglas fir pulps are characterized by high chlorine consumption. Young Douglas fir approaches hemlock and spruce while the pretreated Douglas fir has had its bleachability reduced more than one half and is only slightly higher than young fir.

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Consistency Regulation*

By Frederick Wierk[1]

Abstract

A review of the principles relating to paper stock consistency regulation.

Considerable attention is being paid to the subject of consistency regulation. Though by no means a cure-all, constant maintenance of a desired consistency will leave the operator free to attack his sheet-making problems with more speed and certainty. He will produce less broke and surely less "unsalables."

An analysis of available consistency regulators brings out the fact that the very name of the apparatus is somewhat of a misnomer in respect to the pure physics involved, if we are to maintain our accepted definitions.

The consistency of a suspension of fibers in water has been defined as the weight of dry fibers per unit weight of the suspension. For example, "4 per cent consistency" defines a fiber suspension, 100 pounds of which contain 4 pounds of dry fibers.

All commonly used consistency regulators, however, employ, as the regulatory attribute, the viscosity of the suspension which is under their control.

To convey the idea of viscosity we may assume a large flat trough containing a stationary mass of fluid. If a very large plate having the same density as the fluid be

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pulled through the fluid mass in a horizontal plane, it will be found that adjacent layers of fluid will start to move, owing to the cohesive action between the particles of the fluid. The particles nearest the moving plane will move more rapidly than those farther removed, and there is set up a shearing action between particles in adjacent planes. When the velocity of a mass of particles of fluid in a plane of unit area and unit distance away from and parallel to the moving plate differ from that of the plate by unity, the force per unit area on the moving plate will be numerically equal to the absolute viscosity of the fluid. This, in terms of pure physics, is the definition of absolute viscosity, which can be considered a measure of the internal fluid friction.

The success which has attended the operation of these consistency regulators lies in the fact that there is, for a given stock subjected to a given hydrating treatment, a fairly definite relation between viscosity and consistency. It is obvious that, for successful operation of regulators, the viscosity-consistency relation need not be a truly straight-line relation. The regulator, in controlling the viscosity to a given point on the viscosity-consistency curve will regulate to the corresponding consistency, and therein lies the usefulness of the (so-called) consistency regulator.

The manner in which the various regulators determine the viscosity of the stock differs somewhat in the devices commonly used. The methods employed can be rather sharply divided between mechanical and hydraulic determinations of viscosity.

Mechanical Viscosity Determination

The consistency regulators employing mechanical means for determining viscosity involve the rotation, in the stock, of devices classified generically as "feelers," which may take the form of smooth cylinders, paddles, or the like, and the variations in the torque required to turn these feelers at a constant speed serves to indicate variations in the viscosity of the stock in which the feeler is operating. Regulators employing mechanical determination of viscosity include Bingham, Green, Meyers-Mesco, Noble & Wood, Thyle, and others.

In the regulators employing mechanical determination of viscosity, the torque on the feeler is measured by some form of dynamometer. The dynamometer may take various forms. In one regulator a bevel gear differential is used. Another regulator uses an idler sprocket taking a 180 degree wrap of the tight side of the driving chain between the driving motor and the feeler. Still another regulator uses a torque pendulum arrangement. In another regulator the torque is measured as the armature current in a direct-current motor which drives the feeler.

Hydraulic Viscosity Determination

Since the absolute viscosity of a fluid can also be described as the friction coefficient in Poiseuille's Law covering loss of head in pipes carrying moving fluids, it is apparent that hydraulic means may also be employed to determine viscosity of stock. Regulators involving the hydraulic determination of viscosity are generally arranged so that stock under constant head is supplied through a pipe, tube, or orifice, to another part of the device called, in different make regulators, either a friction-cylinder, viscosity-tube, or sluice. Variations of the viscosity of the stock will result in variations in head in the latter part of the device. Regulators employing hydraulic determination of viscosity include Arca, DeZurik, Foxboro, Hassmann, Trimbey, and others.

In the regulators employing hydraulic determination of viscosity, the head variations are measured by floats, by air-pressure in a bubbling-pipe, by the actual weight of the friction-cylinder, or by the action of the stock on a flap in a discharge sluice.

Stock Dilution

Having determined the viscosity of the stock by some variety of one of the above-mentioned schemes, the regulator has to operate a dilution valve to add the proper amount of water to bring the stock to the desired viscosity. The design, and action, of this portion of the device must present certain definite attributes, namely: minimum lag between determination and correction, and minimum tolerance in respect to variation allowed in the final viscosity as delivered; as well as freedom from hunting.

In these regulators the method of operation of the dilution valve is a most important feature of the device. Referring to the mechanical type regulators, one which employs a bevel gear differential uses a modified self-centering mechanism, with pawls and ratchets to turn a screw arrangement directly connected to the stem of an adjacent dilution valve. Slight time-delay to avoid hunting is introduced by the fact that the pawls are operated only at each revolution of the driving gear to an extent determined by the amount of deviation from the desired condition of normalcy.

A regulator employing the idler with a 180 degree wrap of the tight side of the driving chain has this idler connected directly to the dilution valve mechanism. The valve in this case is double-ported, and the chain force on the idler is balanced against adjustable springs, which results in the valve movement being directly proportional to the torque on the feeler.

One regulator employing a torque pendulum scheme uses the tilt of the entire mechanism to control an electrically operated dilution valve.

In the regulator wherein the torque is measured electrically, current relays are used to control an electrically operated dilution valve equipped with limit switches, solenoid brake, and a graduated orifice in the valve; and an electrical time delay is incorporated to reduce or eliminate hunting.

In a typical hydraulic regulator which uses the weight of the "friction cylinder" as an indication of viscosity, the dilution valve is operated by a double-faced ratchet wheel with opposed pawls for opening or closing the valve. This is a mechanism similar to that used commonly on automatic felt and wire guides.

Hydraulic type regulators wherein viscosity is measured by the air pressure in a bubbling pipe generally use that pressure to control a diaphragm operated valve, sometimes through a secondary pilot valve of similar type, for the dilution water.

Regardless of which scheme is used for either viscosity determination or for dilution valve control, the possibility of hunting is reduced or eliminated by having the sampling point following the dilution point as closely as is physically possible. This cuts down the volume of "off-consistency" stock which must pass before a correction to desired condition of normalcy can be effected.

It is felt that, if the principles of consistency regulation are fairly well understood, there should be very little difficulty in the selection and installation of a device which will satisfactorily maintain desired stock conditions.

Among some operators who have tackled this problem with considerable intelligence there is a feeling that the consistency-viscosity relation is considerably affected by changes in freeness, but the effect of this variable has not been mathematically established, and may be worthy of considerable investigation. It is for that reason that we have qualified this problem in respect to "a given stock subjected to a given hydrating treatment."

A Study of the Coloring Matter in Pine Kraft Pulps*

By Walter F. Holzer[1]

Abstract

1. Coloring matter has been extracted from kraft black liquor and pulp.

2. By means of color absorption curves and change of color with pH, these extracts have been shown to contain the same coloring matter which under the conditions of extraction is obtained as a single type of compound. Here again, the qualification that this statement does not refer to polymeric homogeneity must be applied.

3. The chemical characteristics of the coloring matter are similar to those of the phlobotannins.

4. Analyses of the coloring matter reveal the presence of organic sulphur in it; hence the material is not an ordinary phlobotannin, but is probably a sulphur derivative of a phlobotannin.

5. Analyses for organic sulphur in kraft pulp show that, other variables being constant, the sulphur content is dependent on the sulphudity of the cooking liquor and in unbleached and bleached pulps the color varies directly with the sulphur content.

6. Data have been presented which show that the introduction of sulphur into the coloring matter makes it more difficult to bleach.

7. An attempt has been made to study the oxidation-reduction of the coloring matter in kraft pulp by means of Clark's electrometric titration method with the idea of inhibiting the reaction and making reduction bleaching more valuable. It was shown that the method is inapplicable to the compound and by analogy it was suggested that the coloring is acidic in nature.

When wood is cooked by the kraft process, that is, with a liquor containing sodium hydroxide and sodium sulphide, the resulting pulp has a characteristic red brown color. It might be said that this pulp is noted for two things: first, its strength, and second, its resistance to bleaching. Even today what is considered a well bleached kraft still retains a marked yellow cast, for it is only by special bleaching and other chemical treatment of specially cooked kraft pulp that a bleached stock of good strength, satisfactory chemical constants, and high color can be secured. The cost of such treatment prohibits the general use of the product.

Those engaged in the manufacture of kraft pulp have considered that the color was due to sulphur dyes since the conditions in the digester are favorable to the formation of such compounds. It was not until 1933 that anyone attempted to actually determine the chemical nature of the coloring matter. Kuettel *(4)* definitely opened the problem when he presented his results which linked the color matter with the phlobotannins and their derivatives, the phlobaphenes. His conclusions satisfy the color reactions of the pulp, but his treatment of the possibility of the presence of sulphur compounds and their influence on bleaching is by no means complete. Further than this, his work was definitely limited to the identification of the coloring matter.

It is generally known in the industry that the atmosphere in a kraft digester is reducing in nature and that the pulp, when first dumped, is light yellow in color. This light color is stable when the stock is dry, but a short exposure in the wet state to air or to dissolved oxygen is sufficient to oxidize it to the well-known red brown color. Two methods are in use to produce a light colored kraft without bleaching. One is to overcook the pulp, but this gives a soft stock and reduces the yield. The second is to wash the pulp with dilute white liquor which is an expensive and questionable process. The use of hydrosulphites in a reduction bleach is finding some favor, but here again we encounter the instability of the reduced form of these compounds for reoxidation takes place to a greater or less degree during the paper making process, especially after the addition of the alkaline size. This instability outweighs in part the advantages of the reduction bleach, namely, low cost, ease of operation, and absence of the deterioration of the pulp. If some means of stabilizing the reduced form of the coloring matter could be devised, bright colors could be built on kraft without resort to the more costly and more harmful chlorine bleach. It might be added that, since the reduced form, as already noted, is stable when dry, a partial inhibition of the oxidation is all that is necessary. A means of retarding the reaction long enough to allow the pulp to be converted to paper would be just as effective as a more permanent stabilization.

It will be the object of this work, therefore, to study the chemistry of the coloring matter of kraft pulp insofar as concerns the presence and influence of sulphur compounds and to attempt to carry the general chemistry a step further by studying the oxidation-reduction relations of the substance and the possibility of inhibiting the oxidation reaction.

Historical

It will be of interest to review in a very general way the evolution of the desired qualities in kraft pulp and to point out the more important points which shaped the course.

The kraft or sulphate process is the newest of all the common commercial methods of pulping. It is really a modification of the older soda process and was introduced by Dahl in 1884. Today it is one of the three most important processes, chiefly because kraft is the strongest of all the wood pulps and second because woods unsuitable for other processes can be pulped by this one. The pulp has a characteristic red brown color which is very difficult to bleach. This has limited its use to papers in which strength was required and color was of minor importance. Until recently, this limitation has caused no difficulty. In fact as late as 1915 a considerable tonnage of dyed paper made from sulphite pulp was sold as kraft because the supply of regular kraft was insufficient to meet the demand. It is only natural that this seemingly insatiable demand should cause an uncurbed expansion in the kraft

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industry until now the mill capacity is in excess of demand.

During this same period of general expansion, the chemist, through his development of aniline dyes, has made the public color conscious. Unfortunately, the number and brightness of the colors that can be built on kraft are seriously limited by the dark color of the base stock. The producers of kraft have, therefore, been compelled to turn their efforts towards lightening the color of their pulp to retain their old markets, to say nothing of finding new ones for all the pulp they can produce.

Naturally the first attempts at color removal followed the existing practices of bleaching with hypochlorites. Semi-bleaching, the removal of the reddish brown color to produce a yellow colored stock on which certain fairly bright shades can be developed, is readily carried out at a minor cost and the resulting pulp is not seriously affected in strength. However, to produce a high white, even on the reddish cast, is expensive and the pulp is deteriorated in quality. The kraft has lost its premium of strength and can be substituted by bleached Mitscherlich sulphite at a lower cost. To produce a high white on kraft which approaches bleached sulphite in color without destroying the strength requires an expensive and complicated process so that the resulting pulp is high priced and limited from that standpoint in its sale. Naturally these obstacles have retarded the commercial development of the bleaching of kraft and the mills have waited for the research laboratories to devise simpler and less expensive processes.

The first mention *(7)* of bleached kraft in the literature is made in 1912, when it was reported that kraft could be bleached to a high white with little loss in strength by allowing 5 per cent of hypochlorite to stand on it for 24 hours and then treating with an additional 18 per cent of bleach. Baker and Jennison *(9)* studied the variables in the bleaching of kraft in order that they might standardize the procedure. They claimed to have obtained good color, but made no report of strengths. Sutermeister *(21)* found that the addition of small amounts of bleach to kraft decreased its strength, but that larger amounts increased the strength over that of the original. A maximum was reached at 32 per cent bleach powder. Michael-Jaffard *(10)* was probably the first to report the application of chlorination to kraft bleaching. With chlorination followed by alkaline extractions, he obtained whites superior to those in hypochlorite bleaching.

After these early investigations, the development of kraft bleaching has followed the general trend. By the development of suitable equipment Wolf *(23)* made high density bleaching commercially feasible. The earlier bleach was modified and improved by Fletcher *(12)* and by Collins *(2)*. There is no need to give a detailed discussion of the advantages of high density bleaching since they are well known. Suffice to say that these advantages are particularly helpful in the treatment of kraft. Multistage bleaching was the next development and has been followed more recently by the combination of a stage of direct chlorination with a second of a high density hypochlorite bleach.

Wells *(22)* made a study of the cooking and bleaching of coniferous woods by the kraft process. He found that more could be gained in the yield and quality of bleached pulp by modifying the bleaching process than by modifying the cooking. His best results were obtained in two stage bleaching. In this paper we find the first expression of the belief that the coloring matter in kraft is due rather to a small amount of coloring matter in the nature of a dye than to lignin. Kress and Davis *(16)* carried out a study of bleaching kraft by using direct chlorination in the first stage, following with an alkaline wash, and finishing with a high density hypochlorite stage. Good whites were obtained without loss of strength when the second stage was kept alkaline with caustic soda. The color was inferior when lime was used in place of caustic. Cirves *(10)* recommends a two-stage bleach when the best color and highest strength are required. Rue and Sconce *(20)* obtained the best color at no sacrifice in strength when using direct chlorination followed by a high density hypochlorite bleach.

A second method of lightening the color of kraft pulp is the so-called reduction bleach first employed by Kress *(8)*. This process describes an initial semi-bleach using sulphites or hydrosulphites, followed by a high density hypochlorite stage to produce high whites. Later Kress *(15)* was granted a Canadian patent and Hirschkind *(13)* an American patent on the use of hydrosulphites alone as a means of semi-bleaching kraft. Kress forms the hydrosulphite in contact with the pulp by adding zinc dust, sodium bisulphite, and sulphuric acid in that order. Hirschkind adds the commercially prepared zinc hydrosulphite to the pulp.

Kuettel (4) has done the first work on the chemical nature of the coloring matter in kraft pulp. This thesis was made available to us prior to publication through the courtesy of C. E. Curren of the U. S. Forest Products Laboratory, Madison, Wis. Coloring matter was extracted from pulp and from black liquor, and was purified through the lead salt. When dyed on bleached cotton, it showed all the characteristics of kraft coloring, and, chemically, it showed all the color reactions of the phlobotannins. From this Kuettel concluded that the coloring matter was primarily due to tannins and that sulphur compounds and lignin had only a secondary effect.

A study on the alkaline hydrolysis of lignin is included here, not so much because it has a direct bearing on this work, but rather because it suggests some interesting possibilities which will be discussed later. Honig and Fuchs *(14)* digested some lignosulphonic acid in barium hydroxide solution for several hours. The yellowish brown precipitate which was formed was filtered off. The solution was saturated with carbon dioxide to precipitate the barium and liberate the acid. Since it contained twice as much barium as needed to react with the sulphonic acid group, it was apparent that the substance contained a carboxyl group. The solution had an astringent taste similar to tannic acid and behaved like a tannin of the catechol group with the exception of a red brown coloration with ferric chloride (instead of greenish black) and of no precipitate with bromine water. The residue on evaporation was a yellowish brown powder which contained sulphur.

Theoretical Discussion

A. Tests For Homogeneity of the Coloring Matter

One of the most baffling features in working with natural products is to devise a means of testing the homogeneity of the material under study. The common chemical method alternately determining physical constants and purifying by some means is usually inapplicable on account of the polymeric nature of the materials. Mixtures of different polymers of the same substance or of different substances of similar nature sometimes defy all attempts of separation and purification.

The measurement of the absorption spectrum of a colored compound is one of the accepted methods of identification in organic chemistry. That is, if an unknown has the same absorption spectrum as a known, very little additional evidence is needed to confirm its identity.

The same might be said of two unknowns. If they show the same absorption spectrum, it is most likely that they are identical, although it is not possible to establish the exact identity of either. If, then, the substance under consideration may be a mixture, one way of testing it would be to isolate it from two different sources and by two different methods. Under these conditions it is unlikely that the various components would be present in exactly the same proportions and these variations would change the absorption spectra.

In this study one of the first problems was to test the homogeneity of the extracted coloring matter. To do this two preparations were made. One was isolated from black liquor by means of the lead salt. The other was extracted from pulp with acidified amyl alcohol. Absorption spectra and, more particularly, curves showing the width of the band of light transmitted as a function of concentration showed that there is little if any difference in the two preparations. Further confirmation is added by the study of color change with pH. The coloring matter exhibits what is probably a tautomeric color change with change of pH. In alkaline solution it is a dark mahogany red which changes to a light yellowish brown in acid. The per cent change with change of pH was determined with buffers and a colorimeter and was found to be almost identical for the two preparations. The agreement would indicate that the two extracts are the same substance and under the conditions of their preparation are not a mixture. It must, however, be recognized that the coloring matter is in all probability polymeric in nature. It would, of course, be impossible from the above tests to assume that the extract is pure from the polymeric standpoint; that is, that all chains are of equal length. The statement as to purity refers only to the repeating unit and even here the final result may be only an average; that is, during formation or extraction some of the repeating units may have lost some of their modifying groups. These irregularities are inherent in polymeric compounds especially natural ones and it is only with these qualifications in mind that the above statement regarding purity is made.

B. Tannins and Their Relation to the Color of Kraft Pulp.

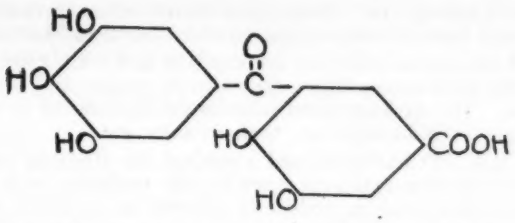
According to Kuettel the coloring of kraft pulp is due to tannins and more particularly to phlobotannins. He discredits the idea that sulphur dyes are an important factor since, in the soda cook where no sulphur is used, the pulp has a similar brownish color.

Tannins are substances which are found in almost all plants, especially of the higher orders. Nothing is known of their origin; theories as to their function differ; and even their definition and classification are subject to argument. In general tannins are compounds which

1. Give bluish or greenish coloration to ferric chloride.
2. Have an astringent taste.
3. Are precipitated by gelatine, albumen, and certain alkaloids.
4. Have the property of converting hides to leather.
5. Contain certain aromatic nuclei.

One can easily understand that the chemistry of a group, whose definition is so vague, is still far from complete. However, considerable work, both analytical and synthetical, has been done on the more common members of the group. On the basis of this work Perkin (*5*) suggests the following classification of tannins:

1. Depsides—Tannins containing an aromatic nucleus consisting of two or more molecules of a phenol carboxylic acid joined through a hydroxy of one molecule to the carboxyl of the next. The commonest members of this group are gallotannins characterized by digallic acid.



2. Diphenylmethylolids—Tannins containing ellagic acid or a related compound as the aromatic nucleus.
3. Phlobotannins—Tannins which on boiling with dilute mineral acid precipitate insoluble red substances known as phlobaphenes.

The class to which an unknown belongs is determined by qualitative tests. Since previous work has pointed out that the coloring matter in kraft belongs to the third group, we will confine the discussion to that group.

Phlobotannins show the following reactions:

1. Fe Cl_3—Greenish black coloration.
2. Bromine water—Orange precipitate.
3. Concentrated $H_2\ SO_4$—Purple ring at the junction of the liquids.
4. Boiling dilute $H_2\ SO_4$—Red precipitate of phlobaphenes.

The extracts gave positive tests in all the above cases except that the precipitate with the boiling acid was almost black instead of red. This is direct confirmation of Kuettel's work. In addition, some of the extract was treated with bleach liquor. A large excess bleached the color to a yellow, but enormous amounts were required to decolorize completely the solution. This is further indication that these extracts are the cause of the difficulty in bleaching kraft.

C. Relation of Sulphur to the Coloring in Kraft Pulp:

A special extraction of pulp was made with acidified amyl alcohol to obtain material for an organic sulphur analyses. The extract was not purified by means of the lead salt, since H_2S is used in removing the load and any sulphur analyses on the final product would then be meaningless. The extract was ash free but did contain appreciable amounts of sulphur. Since any inorganic sulphur would have formed an ash, all the sulphur present was organic. The presence of organic sulphur in the extract constitutes the chief difference between the coloring matetr in kraft and phlobotannins. Since the term "sulphur dye" can be applied to almost any organic compound that has been cooked with sodium sulphide or sulphur and has added sulphur as a result of the process, there appears to be sufficient justification in applying this name commercially to the coloring matter in kraft pulp. Further, sulphur or vat dyes are soluble only in alkali sulphides and in this solution are in a reduced leuco state. The extract exhibits anomalous behavior in being soluble in alkalis and capable of being reduced and reoxidized, thereby making the relation to sulphur dyes more evident.

The work on sulphur in kraft was continued by making a series of four cooks in which the sulphidity was varied from 0 to 100 per cent. In the first place the color of the cooks varied with the sulphidity, soda pulp being the lightest, normal kraft much darker, and the high sulphide cooks increasingly dark. At the same time the organic sulphur increased regularly with the sulfidity of the cooking liquor. A series of alternate bleaches and alkaline extractions ending with a high white without regard to strength showed that the sulphur content of pulp was roughly proportional to the color yet undestroyed.

D. Theory of Oxidation-Reduction Potentials and Their Application to the Coloring Matter

When tannin solutions are exposed to the air, especially in the alkaline condition, they absorb oxygen and become dark. The dark oxidized solution can be reduced by such agents as hydrosulphites, titanous salts, etc.

Clark (*6*) has developed a method for studying oxidation-reduction reactions whereby the tendency of a substance to oxidize or reduce is referred to a relative scale of potentials. On this scale the more powerful oxidizing agents will have a greater oxidation potential and vice versa. The potential is determined by measuring the EMF between a noble metal electrode and a standard reference electrode, both dipping in a solution of a substance capable of being oxidized or reduced while adding known amounts of an oxidizing or a reducing agent. It will be helpful to present in condensed form the theoretical relations as derived by Clark.

The accepted definition of oxidation states that it is the process by which an atom loses one or more electrons and reduction is the process by which the atom gains elecrons. In many cases this can be stated as an equilibrium reaction such as:

$$Fe^{+++} + e \rightleftarrows Fe^{++}.$$

or more generally

$$Ox. + ne \rightleftarrows Red.,$$

where,

$$Ox. = \text{oxidant}$$

and

$$Red. = \text{reductant}.$$

Then from the mass action law

$$\frac{[Ox.]\,[e]^n}{[Red.]} = K.$$

Rearranging,

$$[e] = \sqrt[n]{K\,\frac{[Red.]}{[Ox.]}} \qquad (1)$$

It will not be necessary to derive the well-known equation for the potential of an electrode which may be written

$$E = C' - \frac{RT}{F} \ln [e], \qquad (2)$$

where C's is a constant depending upon the electrode, [e] is the concentration of electrons in solution, and all other symbols have their usual values. If the value of [e] from (1) is substituted in (2), the equation becomes

$$E = C' - \frac{RT}{NF} \ln K \frac{[Red.]}{[Ox.]},$$

which may be written

$$E = C' - \frac{RT}{NF} \ln K - \frac{RT}{NF} \ln \frac{[Red.]}{[Ox.]}.$$

Now, if F is known, the ratio $\frac{[Red.]}{[Ox.]}$ is determinable and E and T are measured, the expression $C' \frac{RT}{NF} \ln K$ may be defined for a given system.

It is impractical to determine the absolute potential E, but if two half cells are set up, the potential between them can be measured. Further, if one of these half cells is considered standard, definite voltages can be assigned to the cell and thus refer the tendency of a substance to oxidize or reduce to a scale of electrode potentials. In practice the potential of a platinum black electrode, saturated with hydrogen gas at atmospheric pressure and immersed in a solution at 25 deg.C. in which the hydrogenions are 1 N, is referred to as zero. Now E_n can be substituted for E, if E_n is defined as the difference between the observed potential and that of the standard electrode. Since $C' - \frac{RT}{NF} \ln K$ is a constant for any system and is expressed in volts, E_0 can be substituted for it. The equation then becomes:

$$E_n = E_0 - \frac{RT}{NF} \ln \frac{[Red.]}{[Ox.]}$$

when

$$[Red.] = [Ox.]$$

then

$$E_n = E_0 - .$$

Thus E_0 is the potential of the system when the oxident and reductant are present in equal amounts and is accordingly defined as the oxidation potential of the system.

A cell of the type recommended by Clark and modified by Conant (*11*) was set up and by use of known compounds was tested and found to be working. However, stable potentials could not be obtained with a solution of the coloring matter. Similar behavior was observed when known phenol carboxylic acids were tested. This shows that the method is not valid for all types of compounds, among which are acids, a fact which is not reported in the literature. It further suggests that the coloring matter is acidic in nature.

EXPERIMENTAL PROCEDURES AND RESULTS

A. Coloring Matter

1. Extraction

The coloring matter was extracted from black liquor and from pulp according to the methods developed by Kuettel 4).

Extraction of Coloring Matter from Black Liquor

Skim off any insoluble soaps and filter out any solids. Acidify the filtrate with HCl, avoiding a large excess. H_2S is evolved and a curdy chocolate brown precipitate is formed. When the evolution of H_2S becomes particularly copious, the solution is near the neutral point. The precipitate is filtered or centrifuged and the clear filtrate allowed to stand for several days. A fine precipitate of sulphur forms on standing and is separated by filtration. When no more sulphur separates, add an excess of lead acetate and filter the voluminous tan precipitate which forms. Wash the lead salt in hot water, dry, suspend in alcohol, and gas with H_2S. When all the lead has been converted to Pbs, filter, and concentrate the reddish brown solution in vacuo. The final stages of the concentration should be carried out in a vacuum dessicator over concentrated sulphuric acid. The residue is a dark, red brown, viscous liquid which should be extracted repeatedly with boiling petroleum ether until only a powder is left.

Four liters of concentrated black liquor obtained from a nearby kraft mill running on jack pine were treated according to the procedure given above. It was found necessary to centrifuge the lead salts since they were so fine that no filter would hold them. When the concentrated extract was treated with petroleum ether, nothing was extracted, even on refluxing for several hours.

When petroleum ether failed to extract the resins, the following solvents were tried:

Chloroform—The coloring matter was partially soluble, but the residue was gummy.

Ethyl ether, turpentine, and *benzene*—Same as chloroform.

Acetone, ethyl acetate—Coloring matter soluble.

Since no satisfactory results were obtained with pure solvents, mixtures were tried. In choosing solvents for the mixture, one was taken in which the substance was completely soluble and one or more in which it was only partially soluble or insoluble. The following mixtures were tried:

Ethyl alcohol and petroleum ether—Complete solution in the alcohol with reprecipitation as a gummy substance on the addition of petroleum ether.

Ethyl alcohol and turpentine—Same as above.
Ethyl acetate and *ethyl ether*—Same as above.
Ethyl acetate, acetone, and *turpentine*—Same as above.
Ethyl alcohol and *acetic acid*—No precipitate.

Removal of the resins was finally accomplished by precipitation with acids. The coloring matter could be dissolved in very dilute ammonia and on making slightly acid, a yellow flocculent precipitate separated and was filtered. The filtrate was a very pale yellow, but darkened to the original color on neutralization with ammonia. This solution showed all the color reactions described by Kuettel.

Small amounts of coloring matter could be extracted from pulp by use either of dilute sodium hydroxide or of acidified amyl alcohol. Kuettel recommends fusel oil, but none was immediately available and amyl alcohol was successfully substituted. The pulp was made from jack pine wood and was obtained from the above mentioned kraft mill along with the black liquor.

Extraction with Amyl Alcohol

Boil 200 grams of pulp with water for two to three hours to extract any soluble material. Drain the pulp as dry as possible on a suction and wash well. Reflux the extracted pulp for six hours with 100 cc. of 6N HCL, 300 cc. of amyl alcohol, and enough water to make the consistency about 6 per cent. The alcohol becomes colored and may be replaced with fresh reagents several times, repeating the refluxing each time. The combined alcohol extracts are washed thoroughly with distilled water to remove the acid and any soluble cellulose degradation products. The washed extract is vacuum distilled to a thick syrup, concentrated in a vacuum over concentrated sulphuric acid for several days, and finally extracted with petroleum ether. The red brown product may be purified by means of the lead salt, but in this case it was not. On account of the small amounts of color that could be extracted from pulp, the use of this preparation was restricted to color curves and sulphur analyses. Of course, any use of H_2S in connection with the removal of lead would have made the sulphur analyses meaningless.

Extraction with Sodium Hydroxide

Treat 200 grams of pulp with 2 per cent of sodium hydroxide for a week. Filter the liquor and neutralize. The filtrate was a reddish brown, which turned yellow on the addition of acid, a brownish flocculent precipitate settling out at the same time. The precipitate is filtered, washed, and dried in a vacuum dessicator over concentrated sulphuric acid.

2. Color Absorption Curves

Spectrophotometric absorption curves were run on a Bausch and Lomb Universal Spectrophotometric outfit.

Since the color of the extracts was so sensitive to pH changes, it was necessary to control the hydrogen on concentration quite carefully. This was done by making the solution slightly ammoniacal and boiling until the last traces were expelled. Any excess acidity was, of course, neutralized by the ammonia and the excess alkalinity could be boiled off. The solutions were checked with litmus to see that no fixed alkalis were present.

On account of the method of purification (precipitating the resins with acid), it was impractical to adjust the concentration to a definite weight per unit volume. Accordingly, the concentration of one was adjusted so that a reading on the spectrophotometer could be made fairly well into the blue. The second was adjusted so that the reading at 600 millimicrons was very nearly the same as that of the first. Readings of the per cent transmission were taken at intervals of 20 millimicrons from 480 to 720 millimicrons. Every reading recorded below was the average of at least three but more often four or five matches with the spectrophotometer. The results are recorded in Table I and are shown in Fig. 1.

TABLE I.—TRANSMISSION OF LIGHT BY KRAFT EXTRACTS ACCORDING TO WAVE LENGTHS

Wave Length Millimicrons	Per Cent Transmission	
	Pulp Extract	Liquor Extract
480	0.77	0.2
500	2.10	0.9
520	5.70	6.5
540	13.30	16.5
560	24.00	27.2
580	34.80	35.4
600	45.60	44.8
620	56.80	50.2
640	65.20	57.2
660	71.40	59.6
680	74.80	65.0
700	78.40	64.6
720	81.60	66.7

The two curves show a striking similarity. When we consider that it was not feasible to adjust the concentration more accurately and further that there is a large inherent error in any determination that depends solely on the visual matching of colors, the difference in the two curves does not appear very large.

The effect of concentration was eliminated in another way. The wave length of the point of total absorption of light by the extracts was determined and its change with concentration was followed. The constant deviation spectrometer was removed from the spectrophotometer outfit. A tube containing the solution was mounted in front of the slit and illumination was obtained from a 6-volt lamp lighted by a storage battery. The original concentration in the tube was adjusted that a band of light was just visible where transmission was greatest. Readings were taken at the limits of visibility on both edges of the band. The solution was diluted by a known amount and readings were taken showing how the width of the band had increased. The process was repeated until further dilution showed very little increase in the width of the band. The readings in the longer wave lengths were limited to 800 millimicrons by the scale of the spectroscope. This was

TABLE II.—CHANGE OF POINTS OF TOTAL ABSORPTION OF LIGHT WITH DILUTION. BLACK LIQUOR EXTRACT

Number of Dilutions	Total Volume	Limits of Visibility in Millimicrons	
1.0	23	627	730
1.3	30	612	748
2.0	46	584	775
3.0	69	568	796
4.0	92	552	
5.0	115	545	
7.0	161	525	
9.0	207	510	
12.0	276	500	
20.0	460	476	

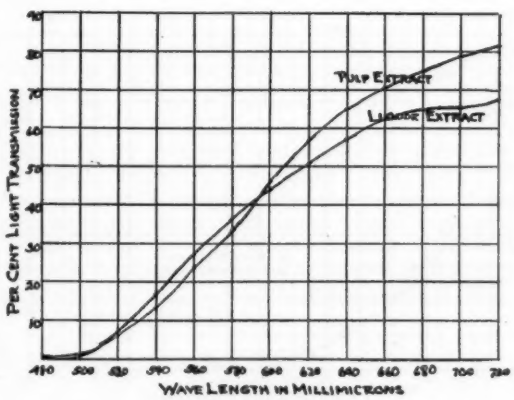


Fig. 1
Spectrophotometric absorption curves of kraft extract.

TABLE III.—CHANGE OF POINTS OF TOTAL ABSORPTION OF LIGHT WITH DILUTION
PULP EXTRACT

Number of Dilutions	Total Volume	Limits of Visibility in Millimicrons	
1	23	617	758
2	46	568	795
3	69	543	
4	92	528	
5	115	514	
7	161	495	
9	207	485	
12	276	470	

not serious, however, since 800 millimicrons is practically the upper limit of the visible spectrum.

The figures reported are on average of at least three or four settings. Those for the black liquor extract are given in Table II and for the pulp extract in Table III. The volume of the cell was 23 cc.

The two solutions were not at the same concentration at the start and had to be corrected before direct comparison could be made. After the last dilution the two solutions were compared on a Du Boscqu-type colorimeter and the pulp extract was found to be 10 per cent stronger than the black liquor extract. Correcting for this, the 276 cc. of pulp extract were equivalent to 304 cc. of the liquor extract at its final dilution. If the original concentration of the black liquor be taken as standard.

$$\frac{304}{460} = \frac{x}{23},$$

then

$$x = 15.2.$$

The original volume of each was 23 cc., but the coloring matter in the pulp extract was equivalent to only 15.2 cc. of the liquor extract. Now by dividing the actual volume of the pulp extract by 15.2, the apparent dilution in terms of the black liquor extract are obtained.

TABLE IV.—CORRECTIONS FOR DILUTION OF PULP EXTRACT

Volume in cc.	Equivalent Dilutions Volume / 15.2
23	1.51
46	3.02
69	4.53
92	6.04
115	7.55
161	10.57
207	13.59
276	18.12

After applying the corrections in Table IV to the data in Table III, the results along with those in Table II are shown in Fig. 2. It is easily seen that when the effects of difference in concentration are eliminated, the similarity of the curves of the two preparations is even more striking. When allowance is made for the probable 3 to 5 per cent error in readings due to the inherent inaccuracy of such optical measurements, the differences between the two curves become negligible and it seems safe to assume that

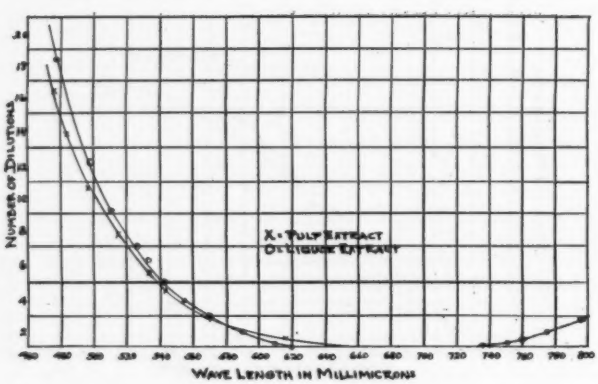


FIG. 2
Spectrometer extinction curves of kraft extracts.

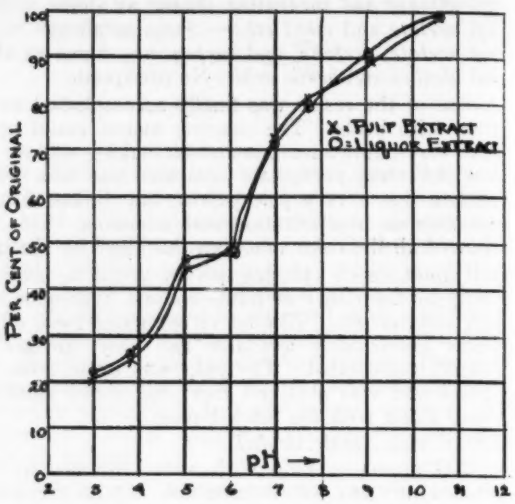


FIG. 3
Change of Color with pH.

coloring matter is an individual compound rather than a mixture.

Further evidence was obtained by studying the relation between color change and pH. Slightly on the acid side of the neutral point, the color of the extracts changes from a dark red brown to a much lighter brownish yellow. The change when examined in a colorimeter is not as sharp as that of dyes chosen for indicators. In the latter case most of the change takes place within two pH units. Appreciable changes were found in the coloring matter under study from pH 3 to pH 11. The sharpest changes, however, were between pH6 and pH7 and again between pH 4 and pH 5. The measurements were made as follows:

One cc. of the extract placed in 10cc. of each known buffer of the range to be studied (in this case ph 3 to pH 11). Samples of two consecutive buffers, e.g., pH10 and pH 11 are placed in a colorimeter and are matched. The higher buffer is then removed and replaced by the one next lower than the one remaining. In the above pH 11 is replaced by pH 9 and another match is made. The process is repeated until all samples have been compared. Since the change is more one of lightening rather than a change of color and since the change per pH unit is comparatively small in most cases, fairly accurate readings of the relative amount of change can be taken by this method. The darkest sample, that is, the most alkaline, can be taken as 100 per cent and the others can be expressed in relative percentages of the first. Table V lists these readings. Graphs are given in Fig. 3.

TABLE V.—PER CENT CHANGE IN KRAFT COLORING MATTER WITH pH

pH	Black Liquor Extract	Pulp Extract
10.5	100 per cent	100 per cent
9.0	92 per cent	90 per cent
7.7	80 per cent	81 per cent
6.9	72 per cent	72.5 per cent
6.1	48 per cent	50 per cent
5.0	47.5 per cent	46 per cent
3.8	26 per cent	24.5 per cent
2.8	22 per cent	20 per cent

As has been pointed out, it is highly improbable that a mixture of compounds will be extracted in the same ratio from different sources using different procedures. Further, it is just as improbable that two compounds, even of similar nature, would exhibit such close agreement in two different properties. This close agreement of the two preparations in the two properties, absorption of light and change of color with pH, can be taken, therefor, as conclusive evidence that the coloring in kraft pulp is due primarily to a single compound and that this compound can be extracted either from the spent liquor or from the pulp itself. Here again, the term "single compound" is used with the qualification made earlier. It does not refer to the polymeric purity but only to the structure of the major repeating unit. From this point on, all work was done with

black liquor extract since it could be prepared in larger amounts.

3. Color Reactions

The chemistry and classification of tannins are vague at best, but there are some reactions which appear to be specific, when taken as a group, for each class. The black liquor extract gave positive reactions with those tests used in identifying the phlobotannins: namely,

1. Fe Cl_3—Greenish black coloration.
2. Saturated bromine water—Orange precipitate.
3. Concentrated H_2SO_4—Purple ring at the junction of the two liquids.
4. Boiling dilute mineral acid—Dark precipitate. In this case the precipitate is much darker than the one expected, being almost black instead of red. The most probable explanation of this is that the extract is a tannin derivative rather than the original compound. This will be discussed later.

From these color reactions it is logical to classify the coloring matter as a phlobotannin as Kuettel, who has gone into this phase more thoroughly, has done.

Some further qualitative reactions are of interest. A small amount of cotton was soaked in the black liquor extract for a few minutes and dried. In color it approached very closely that of kraft, being only slightly yellower, and behaved with acids, reducing agents, and bleach liquor in the same manner as kraft pulp. The experiments with bleach liquor were carried further by adding 10 drops of hypochlorite (30 g. p. l.) to one cc. of the extract. On the basis of solid materials this must have been a large excess of bleach, yet the extract was only half decolorized. An enormous excess of bleach, about 3 cc. of the concentrated liquor, was required to remove completely the color from one cc. of the extract. It was noticed in the case of partial bleaching that there was a tan precipitate when the hypochlorite was exhausted and that the solution was neutral. The sample was shook and divided into two equal portions. One was made alkaline with filtered lime water; the other, with dilute sodium hydroxide. The lime water partially dissolved the precipitate, but the caustic completely dissolved it. This is direct confirmation of the work of Kress and Davis. The more recent trend is toward an alkaline bleach, especially in the last stage. Kress and Davis *(16)* found that in the bleaching of kraft a better color was obtained when the high density hypochlorite stage was kept alkaline and that much better results were obtained with sodium hydroxide than with calcium hydroxide. Previous work on the pH of bleaching with the glass electrode *(3)* shows that as a hypochlorite bleach nears exhaustion, it passes the neutral point and becomes very slightly acid. The usual end point is at a pH of 6.7 to 6.9. Apparently the bleach forms a compound with the coloring matter that is soluble in strong alkali, but becomes insoluble in neutral solutions. If the bleach is kept alkaline, the color matter is rendered soluble and can be washed out. If the bleach is allowed to become neutral or is kept alkaline with a weak alkali such as lime, the coloring matter is precipitated on the fiber and can be removed only by bleaching. This requires enormous amounts of bleach which is harmful to the fiber. All recent developments in bleaching emphasize the importance of rendering the lignin and coloring matters soluble and washing them out rather than actually bleaching them. Advantages are twofold: first, chemical requirements are lower, and second, the product is superior in quality.

4. Organic Sulphur in Kraft Coloring Matter.

Wherever this study has paralleled the work of Kuettel, it has confirmed the earlier work on the more important points. The actual coloring matter has been extracted and its reactions studied as was done before. In addition it has been shown through physical properties that the coloring matter is a single compound and some relations to bleachability have been discussed. The question of the presence and influence of organic sulphur in the coloring matter of kraft pulp still remains to be discussed.

It has been mentioned earlier that kraft operators have usually attributed the color of kraft pulp to sulphur dyes. These compounds are formed by heating vegetable material or organic compounds with sodium sulphur either without or with sodium hydroxide and either dry or wet, depending upon the conditions needed by the particular dye required. Dyes of this type are soluble only in alkaline sulphide solutions and are applied to vegetable fibers in hot baths containing sodium hydroxide and sodium sulphide. The color in the vat is in the reduced form and develops full strength only after being oxidized by the air.

When the conditions under which kraft pulp is made are checked against those given above, it is seen that they are favorable to the formation of sulphur dyes and the fixation of them on the pulp. Wood is cooked at a temperature as high as 185 deg. C. in a liquor containing 10 per cent sodium hydroxide and 5 per cent sodium sulphide. While the conditions are not drastic enough to form dyes in commercial quantities, they are ideal for the fixation of any dye that is formed. Further, the development of the color or oxidation is analagous to that step encountered in the application of sulphur dyes. It is only natural under these circumstances that the formation of sulphur dyes has been accepted as the cause of the color without proof or argument.

Samples of a number of sulphur dyes were obtained from the E. I. du Pont de Nemours & Company, Inc. Several of the samples were dialyzed in a collodion membrane to remove the excess of inorganic salts and elemental sulphur was removed by extraction with carbon disulphide. After dialysis they were stable in acid, some even on boiling. When applied to pulp from an alkaline bath they exhibited the same behavior towards reducing agents, and the same resistance to bleaching as does kraft pulp.

Sulphur can be determined in organic compounds by the well-known method of fusing with sodium peroxide and precipitating the sulphates thus formed with barium chloride in the usual manner. The coloring matter in kraft pulp was tested for sulphur by the following procedure:

About 200 grams of commercial kraft pulp are boiled with distilled water for three hours to remove any soluble material and the pulp is washed with hot distilled water until the filtrate is almost colorless. The washed pulp is extracted with amyl alcohol and hypochloric acid and the coloring matter is recovered as described under the extraction of coloring matter from pulp. The residue is not purified by means of the lead salt since the use of H_2S in the removal of lead would render only subsequent sulphur determinations valueless. The residue is divided into two parts. One part is ashed and the other is fused with sodium peroxide to determine the total sulphur. By subtracting the inorganic sulphur in the ash from the total sulphur found after oxidation, the organic sulphur is determined.

Kraft pulp is produced under alkaline conditions and any inorganic sulphur present after a reasonable exposure to the air would be present as sodium sulphate, or possibly calcium sulphate. Both of these compounds are stable during ashing so that any that may be present would be found in the ash. Analysis of coloring matter extracted from kraft pulp by amyl alcohol, and not purified with lead, gave the following results:

Per Cent Ash	0.10
Per Cent Sulphur from Na_2O_2 fusion	0.78

The ash was so small that it was not analyzed. Even if it contained sulphur or were the product of the decomposition of a sulphate, the amount would be insignificant

compared to the amount of sulphur found after oxidation. Here is definite proof that the coloring matter in kraft contains appreciable amounts of organic sulphur and can accordingly be called a sulphur dye.

Lignin was isolated by Ward D. Harrison of the Institute of Paper Chemistry from black liquor obtained for this study and was found to contain 4.1 per cent sulphur. The lignin was isolated by precipitating with acid, filtering, and washing thoroughly over an extended period of time. A sample was kindly furnished for further study. It was insoluble in water, slightly soluble in alcohol, and readily soluble in fairly strong ammonia, reprecipitating on neutralization. An ammoniacal solution of the lignin was compared with an ammoniacal solution of the coloring matter on the General Electric recording color analyzer. A copy of the curves is given in Fig. 4 and shows that the solutions are quite different, the lignin solution being much more yellow.

This recalls the above reference to the work of Hönig and Fuchs *(14)* on alkaline hydrolyses of lignin. To repeat, they hydrolyzed lignin sulphonic acid with barium hydroxide and obtained a sulphur containing product, which gave many of the reactions ascribed to phlobotannins. The case history was greatly different from that of the coloring extract from kraft and for that reason a direct comparison is questionable. Furthermore, the kind of wood from which their lignin was obtained was not mentioned. However, since their product did not give two of the important classification reactions of the phlobotannins, that is, a red coloration with ferric chloride instead of the usual greenish black and no precipitate with bromine water, it is doubtful whether lignin can be seriously considered as a source of the coloring matter under discussion. The possibility has not been eliminated and the subject of the possible relation between tannins and lignin suggests interesting possibilities for future work.

In the light of this study, confirmed in some points by previous work, it can be said that the coloring matter in pine kraft pulps is an individual compound of the nature of a sulphur dye which reacts similarly to the phlobotannins.

B. Relation of Organic Sulphur to the Color and Bleaching of Kraft Pulp

The theory that the color in kraft pulp is due to sulphur dyes has often been discredited by the fact that soda pulp, in whose production no sulphur is used, has a similar brown color. If it is true that the coloring in kraft is due to a sulphur derivative of a tannin or some other complex organic compound, the color of soda in all probability is caused by the tannin or complex organic compound itself. In order to gain additional data on the relation of organic sulphur to the color in kraft and point out any differences

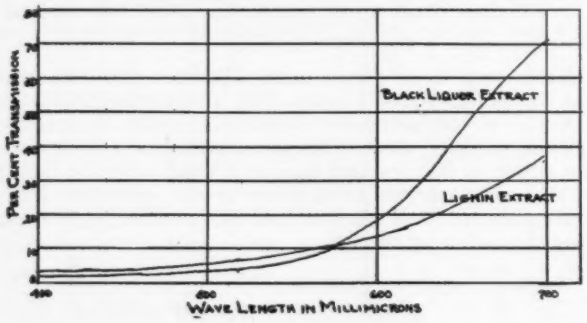


FIG. 4
Spectrophotometric absorption curves of kraft lignin and black liquor extracts.

FIG. 5
Autoclave for experimental cooking.

between soda and kraft, the following series of cooks was made:

(1) Soda cook—20 pounds NaOH per 100 pounds wood.
(2) Kraft cook—13⅓ pounds NaOH + 6⅔ pounds Na_2S per 100 pounds wood.
(3) High sulphide kraft cook—10 pounds NaOH + 15 pounds Na_2S per 100 pounds wood.
(4) Sodium sulphide cook—40 pounds Na_2S per 100 pounds wood.

Since sodium sulphide is not as active a pulping agent as sodium hydroxide, it was necessary to increase the ratio of chemical to wood when the sulphidity was raised above that of normal kraft in order that the pulping action might be maintained. It is well known that small traces of iron in the cooking liquor have a very deleterious effect on the color of pulp. For this reason the cooking liquor was filtered to remove the iron which had precipitated as the sulphide. For the same reason all cooks were made in stainless steel digesters.

Cooks were made in stationery chrome nickel steel autoclaves which have a capacity of 600 grams of oven-dry wood. The autoclaves are supported on three legs high enough so that a gas burner can be placed underneath for indirect heating. The cover is held by eight ⅝-inch bolts and the seal is made by a lead gasket. The cover is fitted with a 250-pound pressure gauge, a thermometer well, and a blow-off valve. See Fig. 5.

The significant data on the four cooks is given in Table VII.

TABLE VII.—COOKING DATA

Cook number	1	2	3	4
Moist weight of wood, grams	642.0	642.0	642	642
Dry weight of wood, grams	600.0	600.0	600	600
Volume of cooking liquor, cc.	3200.0	3200.0	3200	3200
Concentration of liquor, g.p.l.	37.5	37.5	44	75
Total cooking chemical, grams	120.0	120.0	150	240
NaOH, grams	120.0	80.0	60	...
Na_2S, grams	....	40.0	90	240
Weight of chemical / 100 lb. dry wood	20.0	20.0	25	40
NaOH	20.0	13⅓	10	...
Na_2S	....	6⅔	15	40
Maximum pressure, lb. / sq. in.	115.0	115.0	115	115
Time to maximum pressure (minutes)	50.0	55.0	50	45
Time at maximum pressure (minutes)	190.0	185.0	190	195
Total time, hours	4.0	4.0	4	4

All cooks were washed thoroughly on a screen, immediately after dumping and were screened through a plate with 3/32-inch perforations. All four samples of pulp were well cooked, but No. 4 contained slightly more screenings than the rest. Since color and organic sulphur

content were the only data required, no yields, screenings, physical tests or chemical constants were run.

The pulps showed differences in color as might be expected. The soda cook was lightest, followed by the others. The difference between the soda and the normal kraft was the greatest between any two consecutive cooks. The color of the soda was a yellowish brown, whereas that of the kraft was darker and on the red side. The hue of the kraft cook was about the same but the color becomes darker as the sulphide in the cooking liquor was increased. Samples are attached in Fig. VI.

Reflection curves of the four pulps were run on the General Electric recording color analyzer. There is a decided difference in the slope of the soda pulp and the kraft pulp. This is shown in the two graphs reproduced in Fig. 6. The curves of the three krafts are so nearly identical that only one was reproduced. This supports the observation that the color is the same in hue, differing only in darkness.

The pulps were next analyzed for organic sulphur. The method of determination, that of substracting the sulphates found in the ash from those found after a Na_2O_2 fusion, has already been discussed under the analysis of the color extract. Pulps which were analyzed for organic sulphur were electrodialyzed to reduce the inorganic ash content as much as possible. This was done in a redwood box 12 inches by 12 inches by 12 inches. In the center a cell 4 inches by 12 inches by 12 inches was constructed by stretching cheesecloth over a frame fastened to the sides of the box. On either side of the cell a carbon electrode 3 inches by 8 inches was suspended and in back of each electrode an overflow outlet was arranged. The pulp to be dialyzed was dispersed in water and placed in the center cell. Distilled water was run into the cell and overflowed in back of the electrodes. An EMF of 150 volts d. c. could be impressed on the electrodes. This forced a current of 0.2 to 0.5 amperes through the cell. The procedure used with the pulp is as follows:

Before analysis about 70 grams of pulp (dry weight) is placed in the dialyzer described above and dialized for 6 to 8 hours. The ash content is reduced by this procedure to about 0.3 per cent. The pulp is then dried and two 30 gram samples are weighed out. One is ashed and the ash is analyzed for sulphates in the usual way after removing silica by dehydration; the second sample is burned with Na_2O_2 in a Pennock and Martin crucible. About ½ gram of pulp is mixed with 5 times its weight of Na_2O_2. The cover is placed on the crucible and the mixture ignited with a red hot wire. As soon as the crucible is cooled, a second charge is set off. Usually three charges can be ignited before washing out the melt with distilled water. All the extracts are collected and acidified. Any unburned carbon is filtered and the sulphates precipitated with barium chloride. The volume is so large and the amount of sulphates so small that it is necessary to allow the solution to stand several hours for complete precipitation of the sulphates before filtering.

The results of these analyses are presented in Table VIII and Fig. 7.

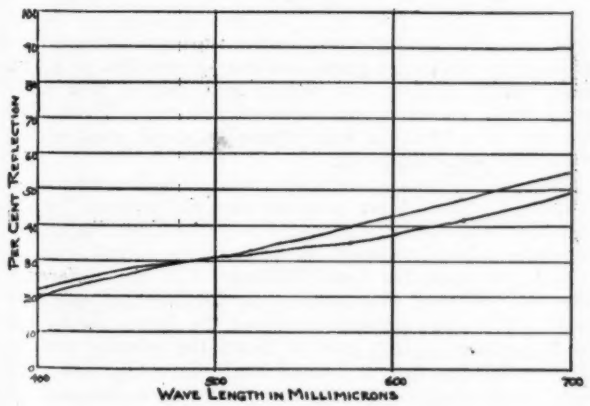


FIG. 6
Reflection curves for pulp.

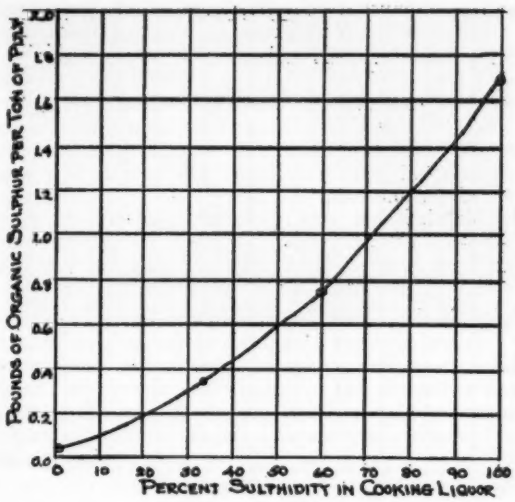


FIG. 7
Variation of sulphur in pulp with sulphidity of cooking liquor.

TABLE VIII.—ORGANIC SULPHER IN PULPS

Cook Number	Per cent Sulphidity	Per cent Ash	mg. $BaSO_4$ in Ash	mg. $BaSO_4$ in Pulp	mg. $BaSO_4$ from Organic Sulphur	Per cent Organic Sulphur	Pound Organic Sulphur Per Ton of Pulp
1	0	0.35	12.6	17.3	4.7	0.001	0.02
2	33⅓	0.20	24.6	59.0	34.4	0.016	0.33
3	60	0.49	101.5	173.4	61.9	0.033	0.66
4	100	0.27	27.5	213.0	185.5	0.085	1.70

It will be seen that the organic sulphur content varies with the sulphidity of the cooking liquor as does the color of the pulp. More correctly, perhaps, the organic sulphur content varies with the sulphidity of the cooking liquor and the color varies with the sulphur content. The decided change in color between the soda and kraft cooks and the small changes between the kraft cooks indicate that there is an important difference between soda and kraft coloring. It has been shown that the coloring matter in kraft is a sulphur derivative, probably of a tannin. In that case the coloring of soda pulp from the same wood would be due to the tannin itself.

The darkening of kraft and the increase of organic sulphur content with sulphidity is most logically explained on the basis of concentration of sulphur in the cooking liquor. Sulphur dyes are compounds of unknown structure and of somewhat variable composition. The more drastic the conditions of preparation and the greater the concentration of sulphur in the reactants, the greater the sulphur content, within limits, of the final product. The same is probably true of the sulphur dye in kraft pulp. The higher the concentration of sulphur in the cooking liquor and the more drastic the cook, other variables being constant, the greater will be the amount of sulphur substituted in the coloring matter and the darker will be the color. Since in this series of cooks the substance from which the coloring matter is formed was a constant, the variation in color was undoubtedly caused by an increase in the percentage of sulphur content, as was found in the analyses.

A second means of studying the relation of organic sulphur is to watch its behavior during bleaching. For this phase the following outline was followed: About 800 grams of commercial kraft pulp was broken up in a beater and washed thoroughly with hot distilled water until the filtrate was practically clear. One-quarter of the pulp was reserved for sulphur analysis; the remainder of the pulp was semi-bleached with C. P. bleach liquor. Twelve per cent chlorine on the weight of the pulp was added and

allowed to exhaust itself. The pulp, which was bleached to a manila color, was then washed with hot distilled water and one-third reserved for sulphur analyses. The remainder was extracted for 3 hours with 2 per cent NaOH and washed. One-half the pulp was retained for analyses; the other half subjected to further bleaching. An additional 10 per cent chlorine as hypochlorite brought its color to a good white for kraft. The sample was washed and saved for analysis.

The bleach liquor was prepared by dissolving a calculated amount of C. P. NaOH in distilled water and adding chlorine gas from a tared cylinder until the liquor contained 30 grams chlorine per liter. A careful test for sulphates showed them to be absent.

A different method of analyzing for sulphur was used in this series. The inorganic sulphur was determined in the ash as before, but the pulp was oxidized in a mixture of concentrated nitric acid and potassium chlorate. This method permitted the use of a larger sample, offered fewer chances of loss, and required less attention than the method using Na_2O_2. It was carried out as follows:

The entire sample of pulp (50 grams) is placed in a Kjeldahl flask, covered with concentrated nitric acid and heated gently until brown nitric acid fumes are evolved freely. Until the pulp is hydrolyzed the reaction generates enough heat to maintain the rate of reaction. When the violent reaction subsides, heat is applied to complete the oxidation and boil off the excess acid. Smill amounts of potassium chlorate are added occasionally to aid in the oxidation and furnish an alkali action to combine with the sulphates formed by the oxidation. The flask is boiled just to dryness to drive off all nitric acid; the residue is then taken up in hydrochloric acid and analyzed for sulphates in the usual way. There is little danger of losing sulphur as H_2S on the addition of the acid because concentrated nitric acid will oxidize the sulphide before it can escape.

The sample numbers are as follows:

1. Unbleached kraft pulp.
2. Semi-bleached kraft pulp.
3. Semi-bleached kraft pulp—alkali extracted.
4. Fully bleached kraft pulp.

The data on these pulps are given in Table IX. The graph, Fig. 8, could not be drawn as a curve because there was no regular relation between the samples, they were rather spot tests.

Again the almost unbelievable resistance of this color to hypochlorites is exhibited. The pulp had been treated with 22 per cent chlorine, nearly one-fourth its own weight, yet a decided yellow cast still persisted and a corresponding amount of organic sulphur was found.

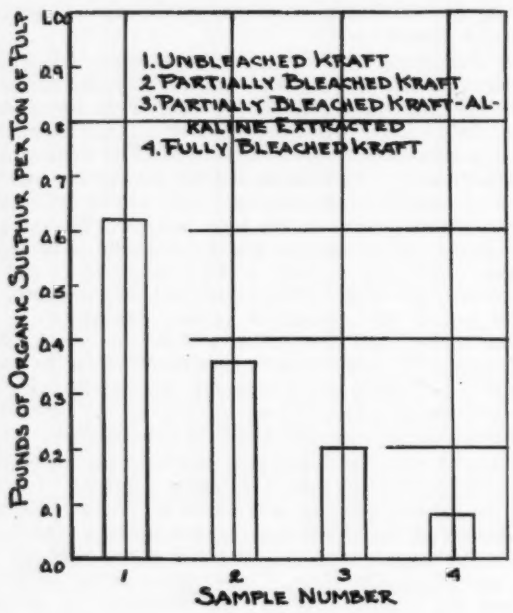


FIG. 8
Decrease in sulphur in pulp during bleaching.

TABLE IX.—RELATION OF ORGANIC SULPHUR TO COLOR IN BLEACHING OF KRAFT

Sample Number	Per cent Ash	mg. $BaSO_4$ from Ash	mg. $BaSO_4$ from Pulp	mg. $BaSO_4$ from Organic Sulphur	Per cent Organic Sulphur	Pound Organic Sulphur Per Ton of Pulp
1	0.68	94.4	209.8	115.4	0.031	0.62
2	0.38	26.5	92.8	66.3	0.018	0.36
3	0.37	7.5	44.5	37.0	0.010	0.20
4	0.26	6.0	20.4	14.4	0.004	0.08

Some soda mills add small amounts of sulphur to their digesters to make the pulp easier to bleach. It is true that it requires less chlorine to bleach a low sulphide kraft than a soda. This gives the impression that the coloring matter in kraft is more easily bleached than soda. To complete the story, however, it should be mentioned that a small amount of sulphide in soda liquor makes it far more efficient in removing lignin. For small amounts of sulphide, the decrease in chlorine demand of lignin is greater than the increase in demand due to the presence of sulphur in the color. While very high sulphide grafts will probably never be encountered commercially, a few data taken from previous work will illustrate the effect that the introduction of sulphur in the coloring matter has on bleaching.

When pulp is chlorinated, the lignin is rendered soluble and practically all of it can be removed by an alkaline wash. The pulp is not lightened in color. In fact, it is usually darker, but the hypochlorites required to bleach it are substantially reduced. Kress and Voigtman *(18)* have studied the chlorination of a Mitscherlich sulphite pulp which had a chlorine demand of 6.8 per cent and a lignin content of 3 per cent. In chlorination 50 per cent of the demand was used and in every case at least 90 per cent of the lignin was removed. From this it seems reasonable to assume that 3.4 per cent chlorine will render 2.7 per cent lignin soluble or 1 per cent chlorine will react with 0.8 per cent lignin. Kress and McGregor *(17)* have reported the results of a study of the influence of sulphidity on the physical and chemical characteristics of kraft pulp. Data pertinent to the discussion have been taken from that paper and are reproduced in Table X.

TABLE X.—DATA SHOWING THE EFFECT OF SULPHUR ON THE BLEACHING OF KRAFT.

Cook Number	Cooking Liquor NaOH	Cooking Liquor Na_2S	Per cent Lignin	Per cent Cl Required for Lignin Calculated	Per cent Chlorine Used	Per cent Cl Available for Bleaching Color
1	20	....	5.4	6.8	15.0	8.2
2	13⅓	6⅔	2.9	3.6	12.3	8.7
3	12	8	3.5	4.4	13.6	9.2
4	8	12	5.3	6.6	19.0	12.4
5	6⅔	13⅓	5.5	6.9	22.8	15.9
6	6⅔	13⅓	8.2	10.2	25.5	15.3
7	6⅔	13⅓	7.2	9.0	26.5	17.5

Notes: Cooks No. 1 and No. 5 inclusive were for 3 hours.
Cook No. 6 was for 4 hours.
Cook No. 7 was for 6 hours.

In this table the per cent chlorine used was that amount required to obtain as good a white as possible in a two stage bleach, using a low density chlorination first stage and a high density hypochlorite second stage. Even with this type of a bleach it was impossible to get good whites in the high sulphide cooks.

Since a chlorination stage was used, it seems reasonable to use the figure (1 per cent chlorine will remove 0.8 per cent lignin) as obtained above. From this figure the values in column 5 are calculated. In column 6 the actual amounts of chlorine used are listed. Column 7 is the difference between these two. It is roughly the chlorine used over and above the amount needed to remove the lignin and by far the larger part of it is used to bleach the coloring matter. Here it is seen that a normal kraft requiring less total bleach than a soda still uses more chlorine to remove the coloring matter. The lignin content is so much lower than that in the soda that the decrease in chlorine demand from

this score is greater than the increase required by the coloring matter. Of course, the pulps produced by the high sulphide liquors are not commercial, but they serve to emphasize the increase in chlorine demand of the coloring matter containing sulphur. This is especially true of Cooks No. 6 and 7. By lengthening the time of cooking the lignin was reduced, but the bleach requirement was actually raised. The lengthened contact with the dye in the liquor apparently increased the sulphur content of the dye or at least made it more difficult to bleach.

The calculations concerning the amount of chlorine required to remove the lignin can be disregarded and similar conclusions can be drawn. Referring to the column on lignin content, it will be seen that the lignin content of the soda cook is about the same as that of Cooks No. 4 and No. 5. From this we might assume that the degree of pulping is comparable. The column containing the amounts of chlorine used shows that the high sulphide krafts required 127 per cent and 152 per cent as much chlorine as the soda cook. This represents an enormous increase, but it is probably caused by a chemical change in the coloring matter which represents a very small percentage of the total weight.

To sum up briefly, it has been shown that other variables being constant the color of kraft is proportional to its organic sulphur content and that this coloring matter is very resistant to bleaching, more so in fact that the coloring matter in soda pulp.

C. Oxidation-Reduction of Coloring Matter

An oxidation reduction cell of the type described by Clark *(6)* and modified by Conant *(11)* was constructed. The cell consisted of a reaction chamber, which was a glass vessel of about 100-cc. capacity with a large rubber stopper, and a second vessel to contain the reference electrode. The two vessels were connected by an agar bridge. In the stopper of the reaction chamber were inserted a platinum electrode, a burette for addition of the oxidizing or reducing solution, a mercury seal stirrer, an inlet and an outlet for nitrogen, and the agar bridge to the reference electrode. Separation of the two electrodes prevented any possible harm to the reference electrode from the reactants. The cell, burette, and stirrer were supported on ring stands. See Figs. 9 and 10.

The system set up to measure the oxidation-reduction potentials is represented by:

Pt | Oxidation-reduction mixture in buffer | KCl—agar bridge | Buffer | Saturated calomel cell

Conant *(11)* recommends the use of hydrogen electrode in place of the calomel cell. On account of the definition of E_n as the difference between the observed potential and that of the hydrogen electrode, if the hydrogen electrode is used as the reference electrode, the observed potential will be E_n without further correction. However, considerable trouble was encountered in the operation of the hydrogen electrode and it was discarded in favor of the glass electrode. The calomel half cell was adopted as the reference electrode and the glass electrode was used only in $_pH$ measurements, according to the following scheme:

Pt | N HCl | Glass | [H+] | Saturated calomel cell

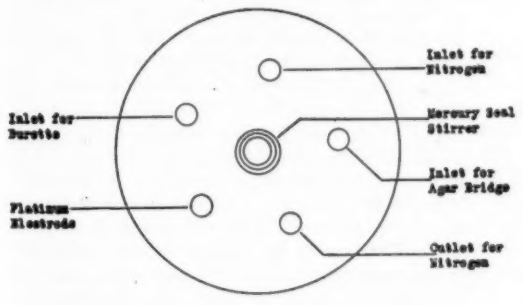


FIG. 9
Diagram showing layout of the reaction chamber.

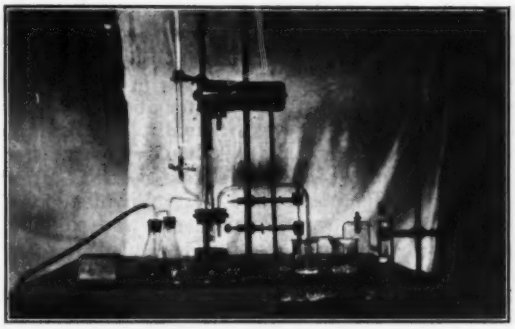


FIG. 10
Oxidation-reduction cell.

The necessary $_pH$ control was obtained by using the buffers recommended by Clark. The buffers were standardized after preparation by means of the glass electrode.

The cell was tested by using known compounds. Those chosen were $\frac{N}{10}$ $Fe(NH_4)_2(SO_4)_2$ and $\frac{N}{10}$ $K_2Cr_2O_7$, both solutions being $\frac{N}{10}$ with respect to H_2SO_4. To 20 cc. of the ferrous solution in the cell, 30 cc. of $\frac{N}{10}$ H_2SO_4 are added to make the volume up to 50 cc. The same acid was placed in the beaker containing the reference electrode. The air in the reaction cell was displaced with tank nitrogen, which was washed in alkaline pyrogallol to remove any oxygen and the stirrer started. The burette was filled with the dichromate solution, the nitrogen stopped, and the cell sealed in and allowed to come to equilibrium. As soon as a constant potential was attained, the titration was started. Potentials took only a short time to come to equilibrium and were quite stable. The data in Table XI and graphed in Fig. II show that the cell was working smoothly.

TABLE XI.—TITRATION OF $Fe(NH_4)_2(SO_4)_2$ WITH $K_2Cr_2O_7$

cc. added	EMF
0	.296
2	.392
4	.414
6	.431
8	.444
10	.456
12	.468
14	.482
16	.498
18	.525
20	.645

With the cell operating properly the following work was proposed:

1. Measure the oxidation-reduction potential of the coloring matter at regular intervals on the pH scale from 3 to 11.
2. At a definite pH, to be selected, measure the effect of known inhibitors of oxidation.

The following procedure for a run was modified from the work of Clark and Conant:

Pipette 45 cc. of the buffer to be used into the oxidation cell and add 5 cc. of a neutral solution of the coloring matter. Slip the vessel into place and start the stirrer and the nitrogen. Fill the beaker used for the glass electrode and calomel cell, with the buffer and check the pH. Make up the reducing solution by dissolving the desired amount of the reducing agent in the buffer. Fill the burette and protect the solution from the air with a little benzene. When the nitrogen has run for 30 minutes, turn it off, seal in the cell, and allow the potential to come to equilibrium. When a stable potential is obtained, add the reducing agent in suitable increments, taking a reading after each addition as soon as equilibrium is attained.

The first reducing agent tried was sodium hydrosulphite

($Na_2S_2O_4$) since it is used successfully in reduction bleaching of kraft pulp. No stable potentials could be obtained. The addition of only a few drops of hydrosulphite would cause enormous changes in voltage and the potential would drift back until after about 20 minutes it would be higher than it was originally. For example, in one case the cell came to equilibrium at an e.m.f. of 207 mv. The addition of one cc. of $Na_2S_2O_4$ (1 gram per liter) changed the potential to 47 millivolts. After 20 minutes the reading was 220 millivolts and still drifting.

The entire equipment was thoroughly overhauled and possible sources of error were checked individually until the only ones remaining were the reducing agent and the coloring matter itself. Other reducing agents including ferrous ammonium sulphate, hydroquinone, and titanous chloride were tried. The first two were not strong enough to reduce the coloring matter and the third behaved the same as hydrosulphite—the potentials were unstable.

It should be mentioned that titanous chloride can be obtained only in strongly acid 20 per cent solution. It was recovered as the crystalline hexahydrate by saturating the solution with anhydrous HCl while cooking, filtering in an atmosphere of carbon dioxide, washing with ether, and drying in a vacuum dessicator over potassium hydroxide.

Known organic compounds were next substituted for the coloring matter. Salicylic acid gave the same unstable potentials noticed with the coloring matter. Hydroquinone was oxidized with dichromate and the quinone thus formed

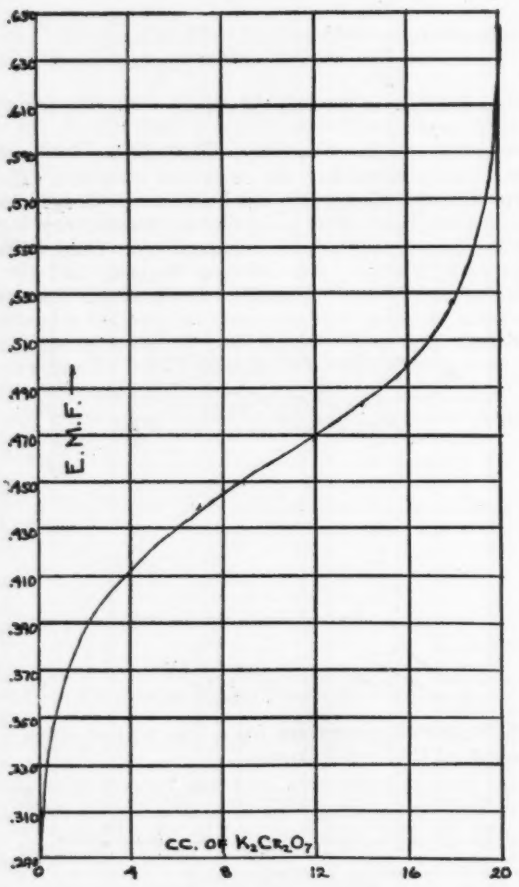


FIG. 11
Titration of $Fe(NH_4)_2(SO_4)_2$ with $K_2Cr_2O_7$.

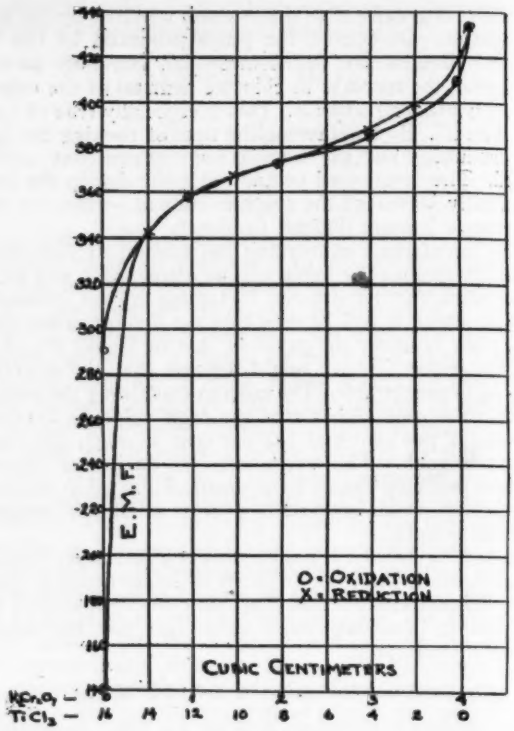


FIG. 12
Oxidation-reduction of Hydroquinone.

was reduced with titanous chloride. In this case the potentials were stable and the curve representing the reduction almost exactly duplicated representing the oxidation. See Table XII and Fig. II for the data.

Apparently one cc. of $K_2Cr_2O_7$ is approximately equal to 4 cc. of $TiCl_3$. If the two curves are plotted on the same co-ordinates, making this correction, as has been done in Fig. 12, it will be seen that they are almost identical.

TABLE XII.—OXIDATION-REDUCTION OF HYDROQUINONE

cc. $K_2Cr_2O_7$	EMF	cc. $TiCl_3$	EMF
0.0	.290	0	.437
1.0	.361	2	.401
2.0	.375	4	.390
3.0	.387	6	.382
4.0	.411	8	.375
4.1	.437	10	.368
		12	.360
		14	.345
		16	.140

A further test using tannic acid gave the usual unstable potentials. The known compounds with which unstable potentials were obtained were acidic in nature. Apparently this type of compounds is not amenable to study by this method. In the literature all compounds which have been studied belong to the quinone family. No suggestions are available as to what compounds cannot be studied by this method. Conant *(11)* points out that the conjugate system C-C C-C may be intimately bound up with the reaction. It may be that the application of this procedure is limited to this type. It is certain that acidic compounds are one type not subject to study by this means. It also suggests that the coloring matter is acidic in nature.

The failure of the method naturally prevented any further study of the possibility of inhibiting the oxidation of the coloring matter. Under the conditions it would appear that further study in lightening the color of kraft would be most profitable if carried out along the lines of modern bleaching, that is, to study the constitution and chemistry of the coloring matter with the idea of rendering it soluble and removing by washing.

Conclusions

The main part of this study has been concerned with the presence of organic sulphur in the coloring matter in kraft pulp and the relation of this sulphur to the properties of the coloring matter.

Samples of pulp cooked with liquors of varying sulphidity have shown that there is a marked change in color when sulphur is first introduced. Thereafter, an increasing sulphidity merely darkens the color. These coloring matters give all the classification reactions of the phlobotannins. In this particular point this study confirms the earlier work of Kuettel *(4)*. In soda pulp made from pine wood the coloring would undoubtedly be due to phlobotannins and in all probability the basic organic structure of the coloring in kraft pulps is essentially the same. However, in the latter case it has been shown that the color and stability has been greatly changed by the addition of sulphur.

It is unfortunate that phlobotannins and sulphur dyes behave similarly to tests which are applicable to both. This refers to lightening in color in acids and reducing agents and reoxidation after being reduced. Further the phlobotannins in being converted to sulphur dyes have not been modified to the extent where they no longer give characteristic tannin reactions. The only means of differentiation have been covered, namely,

1. Observation of color.
2. Study of sulphur content.
3. Difference in stability to hypochlorite.

In the light of this study, therefore, the coloring matter in jack pine kraft pulps is due primarily to a sulphur dye which has a phlobotannin as its organic constituent. The presence of sulphur darkens the color of kraft over that of a comparable soda pulp and makes the kraft harder to bleach in proportion to its organic sulphur content.

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The Effect of pH Upon the Adsorption of Dyes By Cellulose and Fillers*

By Leo Friedman[1] and Delman Vernon Kuykendall, Jr.[2]

Abstract

Studies have been made of the adsorption of acid and basic dyes upon alumina, cellulose, and paper fillers. These studies have demonstrated the important part played by the freshly precipitated alumina and the necessity for careful control of the pH.

Studies of the adsorption of methylene blue upon cellulose, kaolin and talc have shown that the process is true adsorption since it follows the Freundlich adsorption law.

Approximately 96 per cent of all paper manufactured has added to it during the manufacturing process some coloring material. Many workers have called attention to the importance of pH as a primary factor in determining the amount of color that will be retained by the finished product (*1, 2, 3*). Because of the importance of pH in other steps in the manufacture of paper, such as sizing, the quantitative effect of this factor upon the coloring of paper has received little attention. In order to gain a better insight into the nature of the coloring of paper, an investigation of the effect of pH upon the adsorption of dyes by the various constituents of paper was undertaken.

The materials used as adsorbents were: cellulose, alumina, china clay, titanox B, albolith, and barium sulphate. The fillers, supplied through the courtesy of the Paper Makers Chemical Corporation, were screened and only that material passing the 80 mesh and retained on a 100 mesh screen was used. The dyes used were supplied by the General Dyestuff Corporation through the courtesy of H. A. DesMarais. They were methylene blue and victoria green, two basic dyes, and orange R. O. and alizarine blue, acid dyes.

The Effect of pH Using McIllvaine's Buffers

The effect of pH upon the adsorption of the dyes was first studied from solutions the pH's of which were controlled by McIllvaine's buffers. These consist of mixtures of disodium hydrogen phosphate and citric acid and cover the range from pH 2.2 to 8. The experiments were carried out as follows: An exact 1.000 gram sample of the adsorbent was weighed into a 120 cc. Erlenmeyer flask. To this was added 100 cc. of buffer solution containing a known amount of the dye. After 24 hours, 50 cc. of the dye solution was removed and the amount of dye remain-

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ing in the solution was determined by colorimetric comparison with a standard dye solution of the same pH.

Results for the adsorption of Methylene Blue are given in Table I. Outstanding is the much greater adsorption of this dye upon kaolin and talc than upon cellulose and alumina. It should be noted here that the alumina used in this particular experiment was not freshly precipitated alumina, but had been dried at 110 degrees and sieved before using. Adsorption upon kaolin, talc and cellulose increased steadily with increasing pH, whereas upon alumina it increased to a maximum at pH 5 and then decreased.

TABLE I.—ADSORPTION OF METHYLENE BLUE

Original concentration 0.2 g./l.
Percent Adsorption

pH	Alumina	Talc	Kaolin	Cellulose
2.2	0.0	59.0	76.9	8.8
3.0	6.9	64.0	83.0	9.9
4.0	12.5	59.7	81.0	15.0
5.0	15.7	67.8	82.5	12.0
6.0	11.0	73.5	87.0	14.5
7.0	9.9	79.5	92.0	15.3
8.0	8.3	80.5	96.4	20.6

The Effect of pH When Controlled Only by Aluminum Sulfate-Sodium Hydroxide Mixtures

In order to eliminate the possibility that the high salt concentrations of the buffer solutions might be exhibiting an effect as great or greater than the pH, and at the same time in order to more closely approximate mill conditions, the following procedure was adopted: The solutions added to the 1 gram samples of the adsorbents were so made up that they contained a known amount of the dye, 0.2 per cent aluminum sulphate, and varying amounts of sodium hydroxide. In these experiments with increasing pH an increasing amount of alumina was precipitated. The pH was determined electrometrically using the glass electrode.

Results for the adsorption of methylene blue under the above conditions are given in Table II. The same amount of alumina is present in each case at the same pH since the same amounts of aluminum sulfate and sodium hydroxide were used. In these experiments it is therefore possible to make a comparison between the adsorption by the freshly precipitated alumina and the alumina plus the cellulose or filler. Alumina proved to be a poor adsorbent for methylene blue which was also true of barium sulphate, titanox B and albolith. China clay was the only good adsorbent used in this experiment.

TABLE II.—ADSORPTION OF METHYLENE BLUE

Original concentration 0.2 g./l.
Percent Adsorption

pH	Alumina	Alumina and Cellulose	Alumina and China Clay	Alumina and BaSO$_4$	Alumina and Titanox B	Alumina and Albolith
3.73	0	11.4	89.6	1.1	1.1	2.0
4.21	1.0	8.2	93.8	0	0	3.0
4.90	6.0	21.7	74.3	10.5	12.0	11.4
5.41	9.7	20.7	82.2	6.1	6.1	7.9
5.83	5.2	21.7	95.0	9.4	9.4	10.4
6.87	8.1	27.6	25.8	9.2	6.1	8.7

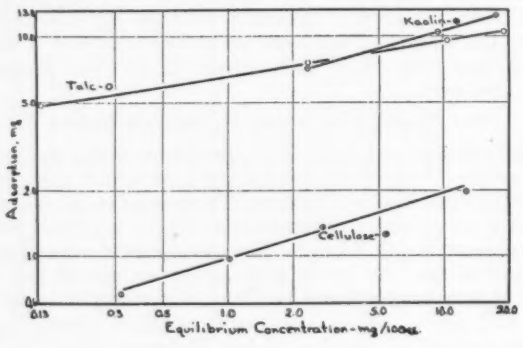

FIG. 1
Adsorption of methylene blue.

Data for the adsorption of Victoria Green are given in Table III. Even though methylene blue and Victoria green are both basic dyes, there is a striking difference in their behavior. The adsorption of Victoria green was in every case greatest in the most basic solution, in agreement with the general statement that basic dyes are best adsorbed from basic solutions. It is to be noted that in some instances the adsorption on filler plus alumina was less than on alumina alone, and that at the highest pH adsorption seems to be dependent entirely upon the alumina.

TABLE III.—ADSORPTION OF VICTORIA GREEN

Original Concentration, 0.3 g./l.
Percent Adsorption

pH	Alumina	Alumina and China Clay	Alumina and BaSO$_4$	Alumina and Albolith	Alumina and Titanox B	Alumina and Cellulose
3.61	0	33.2	3.7	6.8	8.7	7.8
4.25	1.0	26.7	7.5	10.0	9.2	10.0
4.86	6.0	27.7	0.0	6.9	1.0	3.0
5.30	15.3	47.4	11.0	47.1	11.0	13.6
5.90	37.3	63.2	17.5	72.6	53.3	27.2
6.86	95.2	95.1	95.3	95.5	95.5	91.4

Table IV shows that the adsorption of alizarine blue increases with pH to a maximum and thereafter decreases. This appears to be contrary to the general statement that acid dyes are best adsorbed from acid solutions, but in this experiment the amount of alumina increases with increased pH, none being present at a pH of 3.96. The high adsorption on cellulose at this low pH is striking, for at the higher pH's the alumina again seems to be the controlling factor accounting for practically all of the adsorption.

TABLE IV.—ADSORPTION OF ALIZARINE BLUE

Original concentration, 1.0 g./l.
Percent Adsorption

pH	Alumina	Alumina and Cellulose	Alumina and Titanox B	Alumina and Albolith	Alumina and China Clay	Alumina and BaSO$_4$
3.96	0.	36.5	0.	6.2	0.	0.
4.39	79.8	82.4	78.8	84.3	79.1	75.4
5.84	97.7	96.6	97.7	97.1	97.3	98.2
6.25	97.2	96.4	94.2	96.3	95.9	97.0
6.63	93.3	95.9	94.3	95.2	93.9	95.5
8.4	65.0	47.8	...	...	...	53.4

The adsorption of orange R. O., data for which are given in Table V, was very similar to that noted for alizarine blue. With increased pH, adsorption rose to a maximum and then decreased. In this series of experiments, however, the adsorption on alumina plus filler was more consistently higher than on the alumina alone.

TABLE V.—ADSORPTION OF ORANGE R. O. EXTRA CONCENTRATION

Original concentration, 0.2 g./l.
Percent adsorption

pH	Alumina	Alumina and Cellulose	Alumina and Titanox B	Alumina and BaSO$_4$	Alumina and Albolith	Alumina and China Clay
3.66	0	...	14.8	13.3	26.5	5.4
4.19	3.5	16.6	6.1	12.3	12.3	16.1
4.96	42.7	42.3	36.8	41.5	...	46.3
5.44	34.4	33.1	32.7	40.6	69.7	64.5
6.27	26.2	28.6	31.4	36.9	69.1	39.5
7.2	...	34.2	...	6.0	...	25.0

The Nature of the Adsorption of Methylene Blue

There is considerable difference of opinion as to the nature of the adsorption of dyes on paper making materials. Some investigators claim that the process is simply a precipitation of the dye, while others think that a true adsorption process also plays a large part. The simplest method of determining whether the process is a true adsorption is to study the taking up of a dye from solutions of different concentration. If it is a true adsorption the results should be in agreement with Freundlich's adsorption law, $X/m = kc^{1/n}$, where x is the amount of dye absorbed, m is the amount of adsorbent, c is the concentration in the solution at equilibrium, and k and n are constants. Results for the adsorption of Methylene Blue on cellulose, kaolin, and talc are given in Table VI and are plotted on a log-log scale in Fig. 1. When the Freundlich equation is expressed in terms of logarithms it becomes

$$\log x/m = \log k + 1/n \log c$$

which is the equation for a straight line.

With very small amounts of dye present in the solution, adsorption is practically complete, making determination of the equilibrium concentration impossible. It is possible that here the process is not a true adsorption, but the results show definitely that at the higher concentrations Freundlich's adsorption law is followed closely and we are dealing with a true adsorption process.

TABLE VI—ADSORPTION OF METHYLENE BLUE AT DIFFERENT CONCENTRATIONS

Conc'n of dye-bath in mg./100 cc.	Cellulose		Kaolin		Talc	
	Equil. Conc'n	Ad's in mg.	Equil. Conc'n	Ad's in mg.	Equil. Conc'n	Ad's in mg.
1.000	0.348	0.642	....	....	....	....
2.000	1.028	0.972	....	....	....	....
5.000	3.570	1.430	....	....	0.135	4.865
10.000	.....	....	2.46	7.54	2.30	7.70
15.000	13.005	1.995	....	....	....	....
20.000	.....	....	9.70	10.30	10.54	9.46
30.000	.....	....	17.85	12.15	19.41	10.59

Conclusions

One unforseen conclusion must be drawn from the results of these experiments, namely, that the precipitated alumina plays a major role in the adsorption of dyes in the paper making industry. Control of pH accordingly becomes a doubly important factor. First, this control is necessary to bring about a good floc of alumina, and secondly, the pH determines the degree of adsorption of the dye upon the alumina and other materials present.

One important material in paper-making has been neglected in this work, the size. It is possible that this material will also play a major part in the adsorption of dyes and it is our plan to continue these studies with the sizing material present, controlling the pH by adding size to an aluminum sulfate solution.

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Increasing the Usefulness of Less Expensive Paper Fibers With Zinc Sulphide Pigments*

By F. A. Steele[1]

Abstract

Zinc sulphide pigments as fillers are shown to be advantageously adapted to use in paper and boards made with less expensive fibers and are not confined to use in the fine paper field.

Although zinc sulphide pigments are being used in a great variety of paper products, there is no question but that the greatest interest has been displayed by the manufacturers of the finer grades of paper. This has probably been both the cause and the result of the efforts of the pigment manufacturers. Since these pigments are used primarily to improve the opacity and reflectance of paper, it seemed natural to apply them to papers in which the color, reflectance and opacity standards were already high. Unquestionably, the higher price of these papers was also a considerable factor. Considered as a raw material for paper making, the cost of these pigments has seemed rather high, and it seems higher still when the lower price of coarse papers is considered. Some real advantages must be in evidence if a raw material, which costs as much or more per pound than the selling price of the finished product, is to be given serious consideration.

In the past few months, a research program has been in progress to determine whether the usefulness of the less expensive fibrous materials might not be increased by the use of zinc sulphide pigments. So far the study has been confined almost entirely to unbleached sulphite pulps of various grades. In approaching this field, it is clearly recognized that the manufacturers of products containing unbleached fibers will be interested in these pigments only if they will enable him to maintain the quality of his product at a lower cost, or to improve the quality at the same cost. It is always possible to improve quality at an increased cost, and it is seldom necessary to introduce a new type of raw material to accomplish it.

There are quite a number of paper products which are made from a mixture of bleached and unbleached fibers, with or without the addition of old paper. In studying this type of furnish, the cost of the added pigment was offset by adjusting the ratio of bleached to unbleached fiber. For example, if a product is being made from 60 per cent bleached sulphite at 2.75 cents per pound and 40 per cent unbleached sulphite at 2.05 cents per pound, the cost of the fiber in the product is 2.47 cents per pound. If this ratio be changed to 45 per cent bleached and 55 per cent unbleached, the cost becomes 2.365 cents. If a zinc sulphide pigment such as Albalith costing 4.5 cents be added to the latter and if a retention of 70 per cent be obtained, the pigment in the final product would cost 6.43 cents. On this basis, a simple calculation shows that the paper made from the 45-55 furnish could contain 2.6 per cent pigment for the same cost as 60-40 paper, unpigmented. Hand sheets made to illustrate these furnishes gave the following results:

Sample	Ratio Bleached to Unbleached	Per cent Zinc Sulphide Pigment (Albalith)	Reflectance	Contrast Ratio
Ia	60-40	0	.773	.670
Ib	45-55	0	.748	.680
Ic	45-55	2.6	.789	.742

A comparison of the above data shows that Ic represents an inherently more valuable material than Ia, since it has a somewhat higher reflectance and considerably higher opacity, although both have the same cost. If lower retentions are obtained, the cost increases slightly; it becomes 2.50 cents per pound at 60 per cent retention. There are probably many places where such a material could be used to considerable advantage, one or two of which will be suggested.

Boxboard Liners

A mixture of bleached and unbleached sulphite fibers is often used in the manufacture of boxboard liners. Since the function of these liners is largely to hide the darker board underneath, both the reflectance and the opacity of the liner are of importance. The use of a more opaque liner will cover the backing more efficiently and yield a

* Presented at the fall meeting of the Technical Association of the Pulp and Paper Industry, Portland, Ore., Sept. 10 to 13, 1934.
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more attractive product, or, if the original product is satisfactory, it will allow the thickness of the liner to be decreased, thus effecting a saving. The following results on boxboard lined with the material under discussion illustrate both possibilities:

Sample	Weight of Liner	Ratio of Bleached to Unbleached	Per cent Zinc Sulphide Pigment (Albalith) in Liner	Reflectance
IIa	16	60-40	0	.625
IIb	16	45-55	2.6	.648
IIc	14	45-55	2.6	.634

In appearance, these sheets follow the reflectance readings almost exactly. Sample IIb is much superior to sample IIa which, beside being duller, has an unpleasant yellowish cast. Sample IIc, while not as attractive as IIb, is still superior to IIa.

Paper of this general type is sometimes dry waxed for use in wrapping various food products, so this use might be offered as another likely application. The data on these sheets after waxing were as follows:

Sample	Basis Weight 17x22—500	Ratio of Bleached to Unbleached	Per cent Zinc Sulphide Pigment (Albalith)	Reflectance	Contrast Ratio
IIIa	16	60-40	0	.589	.314
IIIb	16	45-55	0	.555	.306
IIIc	16	45-55	2.6	.647	.451

The superior appearance of the pigmented sheet in this case is really remarkable. The high contrast ratio probably contributes even more to this result than the increased reflectance of a thick pile of the paper, enabling a single sheet of the paper to reflect considerable light even though it be covering a very dark background. Over a black background it was found that sample IIIa reflected only 32 per cent of the incident light, while the pigmented sample reflected 46 per cent. This is a most striking example of marked improvement at no cost.

In making a preliminary survey of different types of the less expensive paper fibres and their response to pigmentation, some very interesting results were obtained with certain unbleached pulps, especially selected for color and cleanliness. Such a pulp should have a reflectance of over 75 per cent as compared to ordinary grades which are usually about 65 per cent, and it should be quite free from specks. The pigmentation of this type of fiber yields especially attractive sheets.

While the paper made in this way with sufficient pigment to make it equal in cost to a good bleached sulphite is ordinarily somewhat lower in reflectance than bleached sulphite, the opacity is so very much greater that the paper should have a wide range of usefulness. For example, one unbleached stock yields hand sheets with a reflectance of .725, as compared to about .65 for ordinary grades, while the cost is two or three dollars per ton higher. The data on some hand sheets made from this material were as follows:

Sample	Basis Weight 17x22—500	Pulp	Per cent Zinc Sulphide Pigment (Albalith)	Cost per Pound	Reflectance	Contrast Ratio
IVa	10.4	Bleached	0	2.75	.844	.591
IVb	10.4	Unbleached	0	2.20	.725	.475
IVc	10.4	Unbleached	9.5	2.70	.819	.700

Cost of IVc calculated on the basis of 60 per cent retention.

Data on a high grade bleached sulphite are included for comparison.

While sample IVc can best be evaluated by comparison with the other samples, it is actually to be regarded as a new material. Such a material should find wide application where very high opacity at low cost is required.

As would be expected, when these samples are waxed, the pigmented sample stands out to even a greater extent than before. The following data on dry waxed sheets need no comment:

Sample	Basis Weight 17x22—500	Pulp	Per cent Zinc Sulphide Pigment (Albalith)	Reflectance	Contrast Ratio
Va	10.4	Bleached	0	.667	.196
Vb	10.4	Unbleached	0	.485	.177
Vc	10.4	Unbleached	9.5	.712	.474

In a laboratory investigation of this type, only the general principles of a method can be developed; each specific commercial application brings up its own requirements and problems which must be met as the case arises. In this paper, an attempt has been made to show in a general way the response of some of the less expensive fibres to pigmentation and to dispel any feeling that the use of zinc sulphide pigments is economically confined to the fine paper field. The manufacturers themselves must decide to which of their products these principles can be applied with profit.

The author expresses his appreciation to Castle and Overton, Inc., New York City, who supplied most of the various types of sulphite pulps which were used in this investigation.

Chromium–Nickel Alloys for Sulphite Systems*

By C. C. Snyder[1] and V. W. Whitmer[1]

Abstract

The molybdenum type of nickel-chromium steel alloys, commonly called 18-8-SMO has been shown in a survey of West Coast pulp mills as giving better service than other alloys. Other alloys such as 18-8, 20-10 and 25-10 may be evaluated in this order. Weld decay is prevented by the molybdenum content.

The paper and pulp industry, along with many others, has long been a victim of rust and corrosion. This is particularly true of the sulphite branch of the industry in which sulphuric acid may be referred to as the "Public Enemy No. 1", and its first lieutenants as sulphurous acid, calcium bisulphite, and organic acids resulting from the reaction of the wood pulp. Since the conspirators in this case are known, a definite plan of attack can be outlined, with the assurance of some success in overcoming their effects.

The evolution in metals for sulphite work has been from common steel, through the brasses and bronzes, and now to the stainless and corrosion resisting steels. Results from the field show rather conclusively that there is now a stainless steel "18-8-SMO" (KA2SMO) containing approximately 18 per cent chromium, 10 per cent nickel, 3 per cent molybdenum, and .06 carbon, which very effectively combats the thrusts of rust and corrosion. The aforementioned 18-8-SMO type of stainless steel is a comparatively recent development as far as the paper industry is concerned. The evolution in the stainless group itself has been from the common 18-8 type (18Cr-8Ni),

* Presented at the fall meeting of the Technical Association of the Pulp and Paper Industry, Portland, Ore., Sept. 10 to 13, 1934.
[1] Republic Steel Corporation, Alloy Steel Div., Massillon, Ohio.

20-10 (20Cr-10Ni), 25-12 (25Cr-12Ni), 18-8-STi (18Cr-8Ni plus titanium), to the present standard of 18-8-SMO. A recent survey of a number of sulphite mills on the West Coast by V. W. Whitmer has led to the last statement that 18-8-SMO is rapidly becoming a standard with the mills.

Causes of Failure

The common 18-8 type of stainless was the first of the stainless group of alloys used for sulphite work. Rather indifferent success was obtained with this alloy and it was felt by the steel people, as well as the paper industry, that 18-8 was a border-line alloy, in other words, it varied according to conditions, sometimes being entirely satisfactory, and again, the results being disastrous. An investigation of a number of failures revealed the three causes, all of which are readily eliminated by the use of present day steel practice.

(1) Failure of welds due to carbide precipitation which can be eliminated by the use of low carbon material and the addition of molybdenum.

(2) Failure due to electrolysis caused by contact of stainless steel with dissimilar metals such as brass, bronze, copper, and with graphite packing. By the use of all fittings, flanges, valves, etc., of stainless steel, this objectionable feature was eliminated. In place of graphite packing, mica and asbestos were substituted.

(3) The investigation developed further that the regular 18-8 type is on the fence and that in order to assure its suitability for sulphite service it is necessary to do one of two things, either increase the chromium and nickel contents or add 3 per cent molybdenum. The addition of molybdenum seems to offer the best solution for in addition to its increasing the corrosion resistance of the material immensely, it also inhibits the formation of the detrimental chromium carbides which are apt to result from welding. The Materials of Construction Committee of TAPPI has recommended its use in castings and there are several castings producers who have standardized on the molybdenum analysis.

The chemical analysis of 18-8-SMO as recommended for sulphite service in wrought form follows: carbon .08 max., manganese 1.50 max., phospherous .030. max., sulphur .030. max., chromium 18.00 approx., nickel 10.00 approx. and molybdenum 3.00 approx.

In the survey made of the West Coast mills of which reference was previously made, it developed that all of the sulphite mills were greatly concerned with corrosion. They had all tried stainless steels in some form, either as castings, tubing, or equipment fabricated from sheets and plates, and in nearly every instance agreed that the 18-8 type was not suitable. The transition was from 18-8 to 20-10 and 25-12, the latter being reported much better than 18-8, but still showing some attack. One mill had tried 18-8-S treated with titanium and found it to be even less satisfactory than 18-8, pitting in five months time against an average of about eight months for 18-8. This result is in agreement with other tests and service records in which it has been disclosed that the titanium treated steels show a decreased resistance to acid attack. In the same service just referred to was some equipment of 18-8-SMO which, after fourteen months, showed no sign of pitting or etching and was entirely unaffected.

Circulating System of 18-8-SMO

A number of plants were visited in which circulating system of 18-8-SMO had recently been installed. One plant in particular had four digesters, all of which were equipped with an acid circulating system made by the Electric Steel Foundry Company, Portland, Ore. The equipment consists of a circular ring about 36 inches wide fabricated from 10 Ga. (⅛ inch thick) 18-8-SMO sheets, rolled to the same contour as the inside brick lining, and fastened in place with studs to the outside shell. A circular strainer made up in segments, and perforated with ⅜ inch holes is in contact with this around the edge. The strainer permits the acid to flow to a pipe on one side of the digester, which carries the liquid about half-way down, when it goes through another pipe out of the digester, through a heater, and is again pumped back into the digester at the bottom. The strainer is just below the liquid level at the top, to allow constant flow of liquor. With this system, the total acid is changed every twelve minutes or recirculated five times each hour. Due to the agitation, it is claimed they produce a much higher yield of cooked pulp, as the undigested wood is practically eliminated. Steam consumption and time per cook are also reduced.

In this system (which has been in operation about eight months) the castings are 18-8-Mo, all heat-treated before going into service. The inside ring and piping is Enduro 18-8-SMO sheet, requiring about one thousand pounds per digester. The tubing in the heat exchangers is 18-8-S.

To date, there is no sign of attack in either the sheet or castings. The tubing is 18-8-S, as they were unable to obtain molybdenum tubing at that time. It is, however, available in welded tubing at this time. They do not expect these 18-8-S tubes to last very long, probably a year or so, judging from past experience. They will probably be replaced with 18-8-SMO tubing when failure occurs.

This company has received very good service from 18-8-SMO and has standardized on this product for all sheets, bars and castings used in the sulphite plant.

Another mill has in operation several digesters, each of which is equipped with circulating systems installed early in 1933. 18-8-SMO 11 ga. sheets, with ⅜ inch perforations were used for the strainer in place of castings. These are all in perfect condition today. The heat exchangers were equipped with 18-8-S tubes which all failed in about a year's time. The manager of this plant feels 18-8 sheets are satisfactory for blow pit screens, etc., where rust resistance is a factor and where there is but a small amount of acid and a generous supply of water. However, for equipment handling the cooking acid he feels that the 18-8-SMO type, while perhaps not perfect, is by far the best material available today. In his opinion, the molybdenum products develops a very tough protective film, consequently is much more resistant to localized pitting than the regular 18-8. This gentleman had numerous failures of chrome-nickel castings and wrought products to show but not one of the molybdenum type.

Service records of various metals used in sulphite equipment were obtained from a mill which was one of the pioneers of the use of 18-8 in this country. After six or seven years experience with the various corrosion resisting alloys they have decided that 18-8-SMO is best suited to their needs. Their past experiences runs somewhat as follows:

WELDED SHEET AND PLATE PRODUCTS

Copper—6 inch pipe—Failed in 12 months
KA2S (18-8S)—6 inch 10-ga. pipe—Failed in 9 months
25-12—Pipe—Shows only slight etching and no pitting after 16 months' service
18-8-SMO—6 inch 10-ga. pipe—No sign of corrosion or etching after 14 months' service

CAST PRODUCTS (PIPE, PUMPS, FITTINGS, ETC.)

18-8-MO—No sign of corrosion after 32 months
25-10—Practically no corrosion after 32 months
18-8-MO—Centrifugal cast pipe—Satisfactory after 16 months

SEAMLESS TUBING

18-8-Ti—Shows some pitting after only 5 months

Weld Decay

A discourse on stainless steel would not be complete

without some mention of carbide precipitation or weld decay. This is one topic of which it can be said there has been "much ado about nothing." In the early days of stainless steel, 18-8 was made with fairly high carbon content with the result that when it was welded, carbides separated out at the grain boundaries adjacent to the weld, causing reduced corrosion resistance and eventual failure. As the formation of chromium-carbides are dependent upon the amount of carbon present, it was but logical to reduce the carbon content to a point where even though a few carbides would form, they would be of insufficient number to be detrimental. This accordingly was taken care of and 18-8 with a maximum carbon content of .07 was produced. This automatically took care of weld decay, of which so much misinformation has been written.

Furthermore, it was developed that the addition of other alloys such as molybdenum, titanium and columbium to the low carbon analysis had a further effect on reducing the formation of carbides. Titanium cannot be considered for sulphite work as it is well established that titanium treated 18-8 has even lower resistance to acid solution than regular 18-8. There is insufficient knowledge of columbium treated 18-8 at this time to permit a statement as to its suitability for sulphite work although it is well recognized that it is a potent factor in repressing carbide formation. Molybdenum 18-8, however, has a fine service record behind it, not only in sulphite equipment but in the chemical, and textile and dyeing industries, 18-8-SMO shows much greater resistance to the acid dyes used in textile dyeing which contain small percentages of sulphuric, acetic, and formic acids. The chemical industry has received 18-8-SMO with wide-opened arms for they have found it to be an answer to many of their severest corrosion problems.

Fig. 1 shows the results of a weld decay test conducted on samples of 18-8-SMO with other metals. It is noted that there has been no selective attack at or adjacent to the weld of 18-8-SMO. Figs. 2 and 3 are photographs of equipment fabricated from sheets, tubes and castings of 18-8-SMO by the Electric Steel Foundry Company, Portland, Ore. This equipment is now in service in a West Coast mill.

Physical Properties of 18-8-SMO

18-8-SMO has a yield point of approximately 45,000 pounds per sq. in., and a tensile strength of 90,000 to 100,000 pounds per sq. in. It is quite ductile having an elongation in 2 inches of more than 50 per cent and a reduction of area in excess of 60 per cent. Sheets and plates can be bent flat upon themselves and also deep drawn readily. This analysis can be satisfactorily welded by the acetylene-electric arc and electric resistance methods. Welding rods of the same analysis are available and should be used. 18-8-SMO can be furnished in sheets and plates,

FIG. 1

hot rolled and cold rolled strip, welded tubing, castings, and all accessory parts.

Conclusions

A survey made of a number of West Coast sulphite mills has led to the conclusion that the molybdenum type of 18-8, commonly called 18-8-SMO, is giving much better service than any of its predecessors and is of particular value for circulating systems, in fact it has been responsible for their satisfactory operation. This survey has verified laboratory research work and test installations which revealed the adaptability of this metal for sulphite equipment. Other alloys, such as regular 18-8, 20-10, and 25-10, have been used to some extent and can, perhaps, be evaluated in the order shown, but in the words of several superintendents, 18-8-SMo has been found to be most suited to their needs. In addition to the high corrosion resistance of this latter alloy, there need no fear be expressed of weld decay, as the low carbon content and the molybdenum addition takes care of this angle.

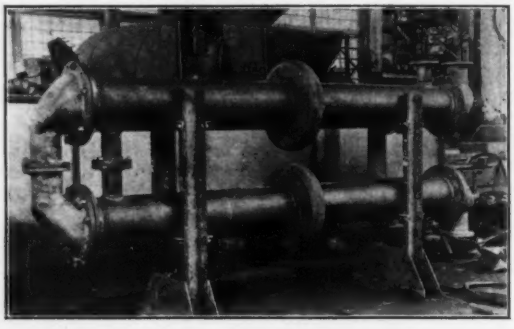

FIG. 2

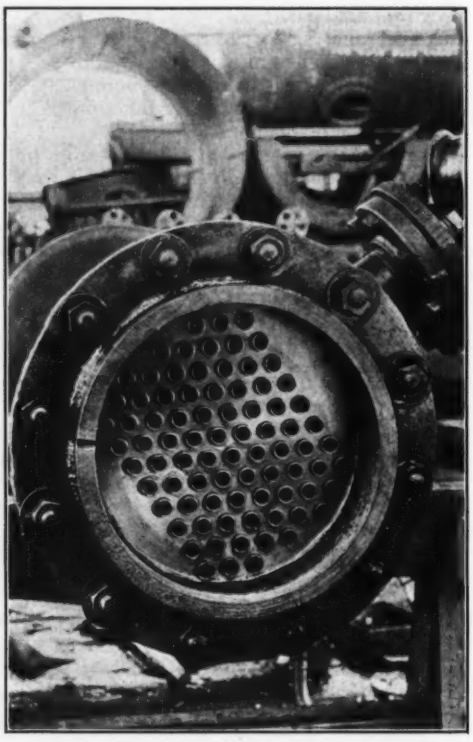

FIG. 3

Pulp and Paper Industry Literature Review

Abstracts of Articles and Patents Compiled by the Abstracts and Bibliography Committee of the Technical Association of the Pulp and Paper Industry, A. Papineau-Couture, John F. Ohlson, C. E. Peterson and Clarence J. West, Chairman

Copies of United States Patents can be obtained from the United States Patent Office, Washington, D. C., for 10 cents each. Send currency, not stamps.

Raw Materials

Production of High-Grade Cellulose from Annual Plants. N. N. Orlov. Bumazhnaya Prom. 13, No. 1:13-32 (1934); C. A. 28: 3889.—A discussion of the foreign methods of production and refining of cellulose from annual plants, such as straws, corn stalks, hemp, chaff, etc., for the manufacture of artificial fiber. Over 100 patent and literature references are reviewed.—C. J. W.

Utilization of Flax Waste in Paper Industry. B. G. Milov. Bumazhnaya Prom. 13, No. 1:40-46; No. 2:64-72 (1934); C. A. 28:3894.——Industrial, mechanical and economical aspects of pulping flax waste and converting it into various types of paper are discussed.—C. J. W.

The Culture of Poplar and its Utilization in the Paper Industry. P. Geisser. Industria carta 1, no. 2:53-59 (Feb., 1934).—A discussion of the economic importance of cultivating poplars on a large scale in order to make the Italian paper industry more independent of imports of foreign pulpwood and pulp.—C. J. W.

The Blue Staining of Timber and the Molding of Wood Pulp. Lauri Alanko. Teknillinen Aikakauslehti 23: 368-374 (1933); C. A. 28: 1498.—A description is given of the life characteristics of the strains of fungi responsible for the blue staining of timber and the discoloration and decay of wet mechanical and sulphate pulp. A brief account is given of the methods used for the preservation of wood and wood pulp.—C. J. W.

Production of Printing Paper from Waste Paper. B. N. Moiseev and P. V. Shumilov. Bumazhnaya Prom. 12, No. 9: 48-51 (1933); C. A. 28: 2901.—A general discussion.—C. J. W.

Problem of Production of Halfstuff. N. N. Nepenin. Leningrad. Oblastnoi Sovet Nauch. Inzhenerno-Tekh. Obshchestoa Tzellyulozno-Bumazhnoi Prom., New Problems of Cellulose-Paper Production 1933, 8-36; C. A. 28: 3231.—The theory and practice of the existing methods for production of halfstuff are discussed.—C. J. W.

Methods of Utilizing Sunflower-Seed Hulls. V. S. Sadikov, I. D. Abramson, A. D. Ruibak and K. S. Belikova. Schriften zentral biochem. Forschungsinst. Nahr.-Genussmittelind. (U. S. S. R.) 3: 308-336 (1933); C. A. 28: 3231. Sunflower-seed hulls are potentially valuable because cheap, abundant and rich in useful materials. Potash can be made from the hulls but it is more profitable to make furfural and cellulose by hydrolysis. The resulting cellulose (about 89 percent alpha-cellulose, copper number 0.5-1.6, ash only 0.1 percent) is excellent for making viscose or for further hydrolysis to fermentable sugars from which alcohol can be made.—C. J. W.

Cellulose from Annual Plants. F. S. Marshak. Russian patent 31,749. Oct. 31, 1933. C. A. 28:3232. (In the preparation of cellulose, annual plants are disintegrated, treated with a weak caustic solution and then with diluted hydrochloric acid before chlorination, so as to make the pulp susceptible to the treatment to follow.—C. J. W.

The Acetyle and Methoxy Content of Spruce Wood. E. Hagglund and O. Sandelin. Svensk Kem. Tid 56, No. 4: 83-87 (April, 1934).—Spruce wood meal was extracted with an alcohol-pyridine mixture to remove the lignin and then bleached. The carbohydrate material left contained one-eighth of the methoxy content and about 60 percent of the acetyl content of the original wood.—C. J. W.

Process for the Production of a Clean Paper Stock from Old Printed Papers. Robert Weber, Drentwede. Ger. pat, 593,427 (April 6, 1930). Addition to Ger. pat. 523,864.—Magnesium hydoxide suspensions of calcium or magensium silicate, barium sulphate, barium carbonate, simple or basic magnesium carbonate, are used alone or mixed together.—J. F. O.

Process for Separating Rubber and Fiber. Arthur W. Bull, assignor to Rubber Regenerating Co. U. S. pat. 1,953,150 (April 3, 1934).—The material is treated on a rubber mill, attrition mill or hammer mill until it has been reduced to sizes not larger than 1 inch in their major dimension. It is then passed through a 4- to 8-mesh screen to remove free rubber, treated in a beater with water for a sufficient time to free most of the rubber from the face of the fabric, screened to remove free rubber, beaten a second time and rescreened, and subjected to gravitational or centrifugal treatment to remove a further amount of rubber. The pulp is then treated with an oil to float the remaining particles of rubber, and the mixed oil and rubber are removed by skimming or centrifuging. The separated fiber and rubber are utilized separately.—A. P.-C.

Method of and Apparatus for Treating and Handling Rags. John L. Cooney. U. S. pat. 1,942,855 (Jan. 9, 1934).—The rags are weighed in bales, cut, and delivered directly from the cutters to a conduit where water is used to convey them to the beaters without dusting. The conduit passes to all the beaters, and over each beater a section of the conduit may be tilted to deliver the rags into any desired beater.—A. P.-C.

Continuous Pulp Selector. Harold D. Wells. U. S. pat. 1,951,684 (March 20, 1934).—The apparatus, which is in effect a waste paper deinking and defibering machine, consists of a suitable tank in which is mounted a rotating screw or impeller member fitting fairly closely in a cylindrical screen open at both ends. The screen is surrounded by a suitable wall to isolate it on the outside from the contents of the tank, and a discharge pipe is connected thereto to lead away the material that has been reduced sufficiently to pass through the screen.—A. P.-C.

Cellulose

Classification of Purified Cotton Fiber According to its Viscosity. Preparation of colloxylin of various viscosities. D. Halperin and D. Tumarkin. J. Applied Chem. (U. S. S. R.) 6: 850-868 (1933); C. A. 28: 3892-3893.—A uniform method has been developed for the regulation of the viscosity of purified cotton cellulose based on modifications of the alkali treatment. It is not advisable to use bleaching for this purpose or to give a special treatment, *e. g.*, boiling in dilute sulphuric acid.

A project is proposed for a standard classification for bleached cotton cellulose according to its viscosity. In this classification the brands are arranged in acordance with the alkali treatment they received, a treatment which will assure the attainment of the corresponding viscosity limits of the cuprammonium solution of the purified cellulose. The basic factors which govern the viscosity of the nitrocellulose of a given nitrogen content are the viscosity (grade) of the original cotton cellulose and the nitration temperature. The remainder of the article deals with the nitration of cellulose.—C. J. W.

Viscosity of Cuprammonium Solutions of Cellulose. A. I. Gershzon. J. Applied Chem. (U. S. S. R.) 6: 721-729 (1933); C. A. 28: 3892.—A new methol for viscosity determinations is based on the principle that on shaking a liquid of a high specific gravity in a viscous medium a coarse emulsion is formed. For cuprammonium solutions mercury is a suitable liquid. The viscometer is built in accordance with the pycnometer principle and the viscosity determination is carried out by the discharge method. In the determination of the viscosity mercury is discharged first and then the cellulose solution. Identical results were obtained with the Nikitin method, the Shirley Institute method and the new method.—C. J. W.

Superficial Esterification of Paper. N. Ya. Solechnik and N. N. Motovilova. Bumazhnaya Prom. 12, No. 10: 39-43 (1933); C. A. 28: 2898.—Paper (4 grams) were wetted with 40 grams of quinolin and then heated in an oil bath with 46 grams stearyl chloride in 150 cc. xylene; the product was washed with boiling alcohol and dried at 100° C. The increase in weight of the esterfied paper was 44 percent (esterification of 0.25 of 1 hydroxyl group) on heating 3 minutes at 100° and 73 percent in 10 minutes at 145° (0.5 of 1 hydroxyl group). The products showed inferior mechanical properties. Esterification to 39 percent decreased the hygroscopicity 50 per cent; esterification to 73 percent changed the hygroscopicity from 11.3 to 2.2 percent. The electrical resistance of 73 percent esterified paper was 8.95×10^{14} as compared with 2.04×10^{10} for the same paper (after an exposure of 44 hours in an atmosphere of 100 percent humidity).—C. J. W.

Constitution of Cellulose. Silk and Rayon 8, no. 4:158-159, 167; No. 5: 211-212 (Apr., May, 1934).—A review of the generally accepted structure of cellulose which has been developed by means of chemistry and X-rays. Results of the different investigators on the length of "glucose chains" are discussed.—C. J. W.

Concerning the Fine Construction of Fiberous Material. Wochbl Papier-fabr. 65, No. 5: 80-81, (Feb. 3, 1934).—A brief review of the important facts concerning the fine structure of fiberous materials. In the beating of cellulose, it has been noted that not only the size of the surface increase but also the increase in the amount of water the surface will hold. From this, it is presumed that the more or less smooth surface of the original fiber is soon changed to that with many fissures and parts of the fiber splitting off.—J. F. O.

Mechanical Process

Shower Water Device for Ground Wood Grinders. Tammerfors Linne och Jarnmanufaktur A. Bol., Tammerfors. Finn. pat. 15,495 (June 1, 1932).—J. F. O.

Wood Fiber Material. Hofasto A.G. Hergiswil, Switzerland. Finn. pat. 15,548 (Sept. 10, 1931).—Method for preparing wood fibers without injury to same.—J. F. O.

Process and Arrangement for the Production of Ring-Shaped Grind Stones from a Mass of Artificial Stone. Dyckerhoff & Widmann A.G. Dresden. Finn. pat. 15,549 (Aug. 13, 1932).—J. F. O.

The New T-W Regulator for Pocket Grinders. Wochbl Papier-fabr. 65, No. 6: 97-98 (Feb. 10, 1934).—Description of the Tauss Wolff regulator for pocket grinders.—J. F. O.

Grindstone and Process of Treating Same. William H. McGill. U. S. pat. 1,959,059 (May 15, 1934).—The stone is thoroughly dried, impregnated under pressure with a solution of a synthetic resin, and heated to drive off the solvent and convert the resin into its insoluble and infusible form.—A. P.-C.

Mechanism for Supporting Grindstones. Dolore F. Theriault, assignor to Great Northern Paper Co. U. S. pat. 1,953,912 (April 3, 1934).—The shaft is provided with the usual right and left-hand threaded portions. A bushing is threaded on each end of the shaft, each bushing consisting of an internally threaded sleeve with a radial flange at its outer end. A collar is interposed between each bushing and the stone and is pressed against the side of the stone by means of thrust screws passing through the flange in the bushing.—A. P.-C.

Alkaline Process

Production of Straw Pulp by the Chlorine Alkaline Method. N. A. Rozenberger. Leningrad. Oblastnol Sovet Nauch. Inzhenerno-Tekh. Obshchestva Tzellyulozno-Bumazhnoi Prom., New Problems of Cellulose-Paper Production 1933: 64-86; C. A. 28: 3895.—The methods of Pomilio-Cataldi (French patent 492,222) and De Vains (French patent 449,947) for the production of cellulose and halfstuff from different straws with sodium hydroxide and chlorine are discussed. Aspen, birch and spruce wood treated in the laboratory with sodium hydroxide and then once with gaseous chlorine produced good quality of pulp and paper.—C. J. W.

Continuous-Stage Cooking of Straw Pulp. N. A. Rozenberger. Leningrad. Oblastnoe Nauch. Inzhenerno-Tekh. Obshchestva Tzellyulozno-Bumazhnoi Prom., New Problems of Cellulose-Paper Production 1933: 55-80; C. A. 28: 3895.—A process and apparatus were developed for the sulphate cooking of straw, resulting in a high grade of pulp and a considerable reduction in the costs of materials and operation. The apparatus with interconnecting units makes it possible to carry on a two-stage cooking process in a continuous operation and to utilize the spent liquors in the cycle. Finely shredded straw is fed through an adapter for mixing with 5-6 parts of liquor (sodium hydroxide or sodium hydroxide and sodium sulphide) and into the first tower and cooked 1.5-2 hours at 90-95°; the whole mass is then forced by a screw conveyor through a screw press, the liquor running down through a piper and the pulp through an adapter, where it is mixed under steam pressure with fresh liquor (sodium hydroxide, and sodium sulphide or sodium hydroxide and sodium sulphite) and dropped into the left limb of the U-shaped tower for cooking at 100° or higher and then passed by a screw conveyor into the second limb of the cooker where the pulp is blown out.—C. J. W.

Rapid Cooking of Straw Pulp. N. A. Strunnikov. Bumazhnaya Prom. 13, No. 2: 77-85 (1934); C. A. 28: 3895.—Considerable economies of time and costs were effected by cooking straw 2-2.5 hours at 4-5.5 atmospheres with 4 percent sodium hydroxide with the subsequent one-stage bleaching with calcium hypochloride (7-8 percent active chlorine) in following the De Vains method of procedure (French) patent 449,947).—C. J. W.

Process for the Pre-Cooking of Wood Before the Cooking of the Pulp. Yrjo Kylander, Helsingfors. Ger. pat. 595,826 (Jan. 26, 1928).—The chips are drenched with acetates or mixtures of sodium hydroxide and acetic acid at the lowest cooking temperatures and under low pressure to prevent a black cook.—J. F. O.

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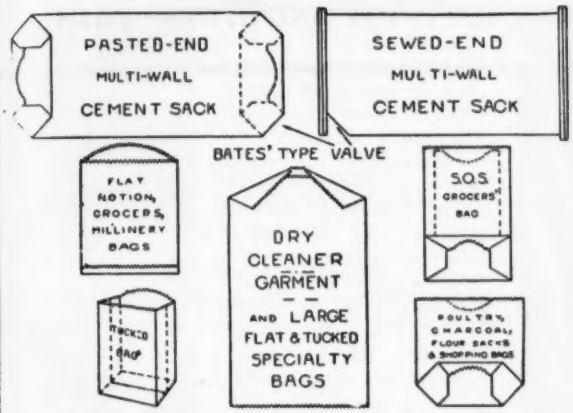

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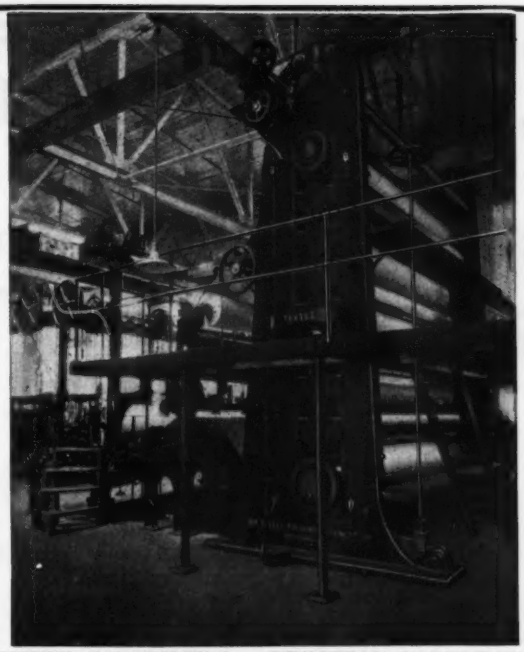

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W. H. S. Lloyd & Co., American Merchant, London, 1 cs., 1 ble.

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Star Co., Markland, Liverpool, N. S., 350 rolls; N. Y. Tribune, Markland, Liverpool, N. S., 1350 rolls; World Telegram, Markland, Liverpool, N. S., 610 rolls; Bridgeport Herald, Markland, Liverpool, N. S., 46 rolls; Jay Madden Corp., Milwaukee, Hamburg, 266 rolls; Wilkinson Bros. Co., Fred. VIII, Oslo, 55 rolls; News Syndicate Co., N. Y. News, Thorold, 2390 rolls; ———, Bergensfjord, Oslo, 139 rolls; ———, Invella, Port Alfred, 250 rolls; Gilman Paper Co., Svaneholm, Kotka, 214 rolls; Jay Madden Corp., Svaneholm, Kotka, 656 rolls; Gilman Paper Co., Svaneholm, Norrkoeping, 882 rolls; Perkins Goodwin & Co., New York, Hamburg, 440 rolls.

PRINTING PAPER

National City Bank, McKeesport, Havre, 9 cs.; Steiner Paper Corp., Milwaukee, Hamburg, 10 cs.

WRAPPING PAPER

F. C. Strype, Black Gull, Antwerp, 5 cs.; Scharf Bros., Veendam, Rotterdam, 7 cs.; Van Oppen & Co., Pr. van Vuren, Genoa, 35 cs.; Titan Shipping Co., American Merchant, London, 1 ble.

KRAFT PAPER

Arkell Safety Bag Co., Kungsholm, Gothenburg, 62 rolls.

DRAWING PAPER

H. Reeve Angel & Co., Inc., American Merchant, London, 3 cs.

COLORED PAPER

———, New York, Hamburg, 3 cs.

FILTER PAPER

A. W. Fenton, Milwaukee, Hamburg, 100 bls.; A. Giese & Son, Veendam, Rotterdam, 5 bls.; J. Manheimer, Olympic, Southampton, 97 bls.; Chas. Happel, New York, Hamburg, 1 cs.; C. Schleicher & Schull Co., New York, Hamburg, 15 cs., 1 ble.

SURFACE COATED PAPER

Globe Shipping Co., Milwaukee, Hamburg, 29 crates, 10 cs.; Gevaert Co. of America, Nubian, Antwerp, 19 cs.

METAL COATED PAPER

K. Pauli Co., Milwaukee, Hamburg, 27 cs.; ———, New York, Hamburg, 5 cs.; Stone & Downer, New York, Hamburg, 8 cs.

BASIC PAPER

Globe Shipping Co., Milwaukee, Hamburg, 5 cs.

TRACING PAPER

Titan Shipping Co., Bremen, Bremen, 6 cs.

TRANSFER PAPER

Phoenix Shipping Co., New York, Hamburg, 14 cs.

DECALCOMANIAS

Sellers Transportation Co., Bremen, Bremen, 7 cs.

DECALCOMANIA PAPER

B. F. Drakenfeld & Co., Scythia, Liverpool, 32 cs. (duplex.)

TISSUE PAPER

Jay Madden Corp., Bremen, Bremen, 25 bls.; F. C. Strype, Scythia, Liverpool, 1 cs.; ———, Pr. van Buren, Genoa, 3 cs.

STENCIL PAPER

Chas. Happel, Nubian, Antwerp, 3 cs.

MISCELLANEOUS PAPER

Kraemer & Co., Kungsholm, Gothenburg, 161 bls.; The Borregaard Co., Inc., Kungsholm, Gothenburg, 161 rolls; Standard Products Corp., Pr. Cleveland, Yokohama, 4 cs.; T. N. Fairbanks, Pr. Cleveland, Yokohama, 3 cs.; ———, Milwaukee, Hamburg, 5 cs.; Irving Trust Co., P. Maersk, Kobe, 31 cs.; Coty Processing Co., Lafayette, Havre, 7 cs.; Almo Trading & Import Co., Paris, Havre, 13 cs.; J. W. Masters & Co., Paris, Havre, 3 cs.

RAGS, BAGGINGS, ETC.

E. J. Keller Co., Inc., Black Gull, ———, 392 bls. bagging; ———, Black Gull, Antwerp, 172 bls. cotton waste; Irving Trust Co., McKeesport, Havre, 51 bls. new cuttings; Vinton Mills, McKeesport, Havre, 2 bls rags; Royal Manfg. Co., American Shipper, Manchester, 50 bls. cotton waste; ———, Veendam, Rotterdam, 65 bls. rags; J. Cohen Son Co., American Merchant, London, 30 bls. rags; ———, Clairton, Glasgow, 17 bls. rags; J. J. Ryan & Son,

DROP AND STEAM HAMMER forgings..

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PLANTS IN ALL PAPER MAKING AREAS
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Tela, Rotterdam, 200 bls. cotton waste; Royal Manfg. Co., Tela, Rotterdam, 158 bls. cotton waste; Chase National Bank, New York, Hamburg, 41 bls. rags.

BONE GLUE

———, New York, Hamburg, 50 bags.

OLD ROPE

Chase National Bank, Tela, Rotterdam, 41 coils.

CHINA CLAY

English China Clays Sales Corp., Scythia, Liverpool, 200 bags; ———, Scythia, Liverpool, 25 casks; L. A. Salomon & Bro., Scythia, Liverpool, 140 bags.

CASEIN

D. C. Andrews & Co., New York, Hamburg, 50 bags.

WOOD PULP BOARDS

Johaneson Wales & Sparre, Inc., Svaneholm, Wiborg, 250 rolls.

WOOD PULP

Perkins Goodwin & Co., Kungsholm, Gothenburg, 127 bls. kraft pulp; ———, Dalhem, Hernosand, 3150 bls sulphite, 525 tons; Chemical Bank & Trust Co., Bergensfjord, Oslo, 300 bls. sulphite; J. Andersen & Co., Bergensfjord, Oslo, 1663 bls. sulphite; The Borregaard Co., Inc., Bergensfjord, Sarpsborg, 336 bls. sulphate; ———, Cliffwood, Stugsund, 500 bls. sulphate, 100 tons; ———, Cliffwood, Stugsund, 750 bls. sulphite, 150 tons; Bank of Manhattan Co., Cliffwood, Sundsvall, 1950 bls. sulphite, 325 tons; Bank of Manhattan Co., Cliffwood, Sundsvall, 600 bls. sulphate, 100 tons; ———, Cliffwood Sundsvall, 3000 bls. chemical pulp, 600 tons; Brown Bros. Harriman & Co., Cliffwood, Sundsvall, 250 bls. chemical pulp, 50 tons; Brown Bros. Harriman & Co., Cliffwood, Sundsvall, 1500 bls. sulphite, 300 tons; ———, Cliffwood, Sundsvall, 2400 bls. sulphate, 400 tons; ———, Cliffwood, Hernosand, 1426 bls. sulphate, 327 tons; ———, Cliffwood, Hernosand, 1920 bls. sulphite, 320 tons; Lagerloef Trading Co., Svaneholm, Vasa, 1825 bls. sulphite, 306 tons; Lagerloef Trading Co., Svaneholm, Vasa, 407 bls. mechanical, 81 tons; Lagerloef Trading Co., Svaneholm, Wiborg, 1779 bls. sulphite, 326 tons; Lagerloef Trading Co., Svaneholm, Kotka, 165 bls. sulphite, 27 tons; Lagerloef Trading Co., Svaneholm, Kotka, 600 bls. sulphate, 72 tons; Bank of N. Y. Trust Co., New York, Hamburg, 855 b'ls. wood pulp, 171 tons; Castle & Overton, Inc., New York, Hamburg, 290 bls. wood pulp, 58 tons.

PULPWOOD

Polarus Shipping Co., Pollux, Soldiers Cove, 1255 cords;

ALBANY IMPORTS

WEEK ENDING SEPTEMBER 15, 1934

Johaneson Wales & Sparre, Inc., Dalhem, Sundsvall, 1400 bls. sulphite, 255 tons; Johaneson Wales & Sparre, Inc., Dalhem, Sundsvall, 250 bls. chemical, 50 tons; Perkins Goodwin & Co., Dalhem, Sundsvall, 4002 bls. sulphate, 667 tons; Perkins Goodwin & Co., Dalhem, Sundsvall, 1150 bls. sulphite, 230 tons; Perkins Goodwin & Co., Dalhem, Soderhamn, 9165 bls. sulphate, 1833 tons; Bulkley Dunton & Co., Dalhem, ———, 850 bls. wood pulp, 150 tons; Bank of N. Y. Trust Co., Dalhem, Hernosand, 9102 bls. sulphate, 1517 tons.

PORTLAND IMPORTS

WEEK ENDING SEPTEMBER 15, 1934

Bulkley Dunton & Co., Griesheim, ———, 1000 bls. wood pulp; Bulkley Dunton & Co., Tisnaren, ———, 3000 bls. wood pulp; Bulkley Dunton & Co., Ditmar Koel, ———, 1500 bls. wood pulp.

BOSTON IMPORTS

WEEK ENDING SEPTEMBER 15, 1934

G. F. Malcolm, Inc., Scythia, Liverpool, 40 cs. tissue paper; Atkinson Haserick & Co., Pr. van Buren, Genoa, 2 cs. wrapping paper; Leigh Textile Co., City of Flint, Manchester, 64 bls. cotton waste; H. E. Harris & Co., City of Flint, Liverpool, 20 bls. waste paper; Bank of Manhattan Co., Cliffwood, Sundsvall, 2310 bls. sulphate, 385 tons; ———, Cliffwood, Sundsvall, 600 bls. sulphate, 100 tons; Brown Bros. Harriman & Co., Cliffwood, Sundsvall, 4500 bls. sulphate, 750 tons; Perkins Goodwin & Co., Cliffwood Munksund, 3000 bls. sulphate, 500 tons; ———, Cliffwood, Hernosand, 180 bls. sulphate, 30 tons; ———, Cliffwood, Hernosand, 300 bls. sulphite, 50 tons; Bulkley Dunton & Co., Griesheim, ———, 125 bls. wood pulp; Bulkley Dunton & Co., Ditmar Koel, ———, 2250 bls. wood pulp.

PHILADELPHIA IMPORTS

WEEK ENDING SEPTEMBER 15, 1934

Irving Trust Co., McKeesport, Havre, 39 bls. new cuttings; E. J. Keller Co., Inc., McKeesport, ———, 185 bls. rags; N. Y. Trust Co., Binnendyk, Rotterdam, 270 bls. wood pulp; Bank of Manhattan Co., Cliffwood, Sundsvall, 2700 bls. sulphite, 450 tons; Bank of Manhattan Co., Cliffwood, Sundsvall, 180 bls. sulphate, 30 tons; ———, Cliffwood, Sundsvall, 500 bls. sulphite, 100 tons; Johaneson Wales & Sparre, Inc., Cliffwood, Sundsvall, 150 bls. sulphite, 30 tons; M. Sone, Haimon, Hamburg, 1002 bls. wood pulp.

CAMDEN IMPORTS

WEEK ENDING SEPTEMBER 15, 1934

Bulkley Dunton & Co., Cliffwood, ———, 600 bls. sulphate, 100 tons; ———, Cliffwood, Hernosand, 1200 bls. sulphate, 200 tons.

BALTIMORE IMPORTS

WEEK ENDING SEPTEMBER 15, 1934

———, City of Flint, Liverpool, 112 coils old rope; N. Y. Trust Co., Binnendyk, Rotterdam, 1080 bls. wood pulp; Bulkley Dunton & Co., Topeka, ———, 3125 bls. wood pulp.

NEWPORT NEWS IMPORTS

WEEK ENDING SEPTEMBER 15, 1934

Bulkley Dunton & Co., Topeka, ———, 2250 bls. wood pulp.

NORFOLK IMPORTS

WEEK ENDING SEPTEMBER 15, 1934

———, Winona County, Manchester, 144 bls. cotton waste; ———, Winona County, Liverpool, 49 bls. cotton waste; Keasby & Matteson Co., City of Flint, Manchester, 5 cs. paper; R. J. Reynolds Tobacco Co., Binnendyk, Rotterdam, 1302 cases cigarette paper.

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of

AWLCO-IZED YELLOW PINE

Last 2½ TIMES as long as ordinary lumber

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ELIZABETH, N. J.

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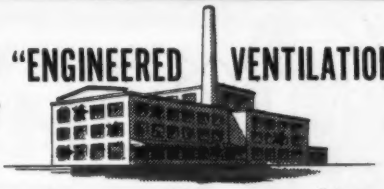

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Our engineering staff will be glad to study your problems and submit estimates.

TICONDEROGA MACHINE WORKS
Ticonderoga, N. Y.

New York Market Review

Office of the PAPER TRADE JOURNAL,
Wednesday, September 19, 1934.

Influenced to some extent by general business conditions the local paper market was only moderately active during the past week. There are a number of inquiries around for future account some of which should materialize into good orders. Sales forces of the leading paper organizations are preparing for a strenuous campaign now that the holidays are drawing to a close.

Production of newsprint paper in North America during August amounted to 329,158 tons, according to information gathered by the News Print Service Bureau. The total North American output during the first eight months of the year increased 486,728 tons over the corresponding period of the preceding year, or 23.4 per cent.

The fine paper market is practically marking time while awaiting the usual resumption of trading at this season of the year. Prices continue steady. Tissues are moving in fair volume. The coarse paper market is fairly active with specialties displaying strength. Prices are holding to schedule, in most instances.

Mechanical Pulp

Steadiness prevails in the ground wood pulp market. Manufacturing operations in this country and abroad are being maintained in sufficient volume to take care of current requirements and accumulation are not excessive. Prices are generally holding to previously quoted levels and shading is infrequent.

Chemical Pulp

Both domestic and imported grades of bleached and easy bleaching sulphite pulp are holding up well. Prices are steady and unchanged. Foreign kraft pulp is somewhat softer. Imported No. 1 kraft pulp is now quoted at from $1.70 to $1.80 per 100 pounds and No. 2 at from $1.55 to $1.65, on dock, Atlantic ports.

Old Rope and Bagging

The old rope market is slightly easier. Paper mill demand for old manila rope is light. Small mixed rope is moving slowly. The bagging market is irregular. Gunny bagging is exhibiting a strong undertone. Scrap bagging is listless. Roofing bagging is going forward in satisfactory volume for the season.

Rags

Although the domestic rag market is quiet there is a persistent demand for several grades for export. Paper mill interest in new cotton rags is lacking, in most instances, but No. 1 white shirt cuttings are displaying strength. Roofing grades are going forward in moderate volume. The position of the imported rag market is unchanged.

Waste Paper

The paper stock market is stronger, although board mill demand for the lower grades continues light. The price situation is unchanged. The higher grades of waste paper are moving more freely, including hard and soft white shavings, hard white envelope cuttings and book stock. Prices are well sustained.

Twine

Business in the local twine market is moderately active. While demand for the various grades is mostly along routine lines, inquiries are fairly numerous and the outlook for the closing months of the year is considered promising. Despite keen competition for desirable orders, quotations are steady.

Mechanical Tubing at Important Centers

Steel and Tubes, Inc., of Cleveland, Ohio, have recently undertaken to establish distributors of electrically welded Mechanical Tubing in the important tubing centers of the United States. National warehouse distribution of Electrunite Boiler Tubing has already been established, but until recently this policy had not been applied to Mechanical Tubing.

The first warehouse stock of Mechanical Tubing established by Steel and Tubes, Inc., was that with Tubular Service Corporation of New York, Philadelphia and Boston. Since then, stocks have been put in by Service Steel Company at Detroit, Williams and Company at Pittsburgh, The Hamilton Steel Company at Cleveland, and Edgar T. Ward's Sons Company at Chicago.

This presents complete stocks of Electrunite Mechanical Tubing to users of that product at points which have already been proven most important. Within the short space of time since these arrangements have been completed, the value of this set-up has made itself quite apparent.

Paper Amendments Not Satisfactory

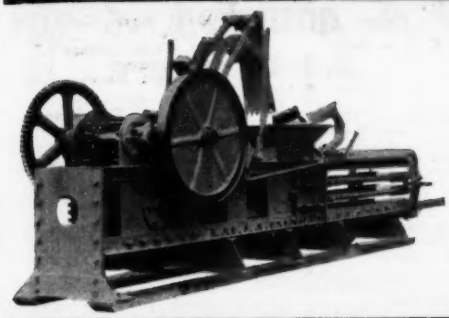
[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., September 18, 1934—Representatives of PIA are here today conferring with NRA Deputy Administrator Tulley and other NRA officials in connection with amendments to the paper code. The amended code presented to NRA on June 29 at hearing is not acceptable to the government. PIA has suggested proposed amendments to the present code and these will be put up to various divisions of the paper industry before any further action is taken.

S. B. Behrens & Co. Move

S. B. Behrens and Company announce their removal to new and larger quarters at 949 Broadway. The new phone number is Algonquin 4-0964.

The Sabin Robbins Paper Company, represented by S. B. Behrens, also announces its removal to the same address.



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Let us show you what a GOOD lubricant can do towards savings on power and less wear on your equipment.

PORT HURON XYLITE COMPANY
GREASES, OILS, SOAPS

PORT HURON MICHIGAN

Miscellaneous Markets

Office of the PAPER TRADE JOURNAL,
Wednesday, September 19, 1934.

BLANC FIXE.—The position of the blanc fixe market is unchanged. Prices are holding to schedule. The pulp is quoted from $42.50 to $45 per ton, in bulk; while the powder is selling at from 3½ to 3¾ cents per pound, in barrels, at works.

BLEACHING POWDER.—Steadiness prevails in the bleaching powder market. The contract movement is normal for the season. Prices are maintained at recently quoted levels. Bleaching powder is quoted at from $1.90 to $2.15 per 100 pounds, in drums, at works.

CASEIN.—The casein market is firmer. Domestic standard ground is now quoted at 12 cents and finely ground at 12½ cents per pound, in bags, car lot quantities. Offerings of Argentine standard ground and finely ground are scarce and prices nominal.

CAUSTIC SODA.—Demand for caustic soda is moderately active. The contract movement is regular. Solid caustic soda is quoted at from $2.60 to $3.10; while the flake and the ground are selling at from $3 to $3.05 per 100 pounds, in large drums, at works.

CHINA CLAY.—The china clay market is displaying a strong undertone. Foreign china clay is quoted at from $13.50 to $21 per ton, ship side. Effective October 1, minimum prices on domestic paper making clay will range from $6.50 to $12 per ton, at works.

CHLORINE.—Some improvement was noticed in the demand for chlorine. Contract shipments are moving in good volume. Prices remain unchanged. Chlorine is quoted at from $2 to $2.25 per 100 pounds, in tanks, or multi-unit cars, in ton lots, or over, at works.

ROSIN.—The rosin market is fairly steady. Paper making gum rosin is quoted at $4.32½ and wood rosin at $4.30 per 280 pounds, in barrels, at southern shipping points. Rosin size is selling at $2.55 per 100 pounds, in tank cars, at works.

SALT LAKE.—The salt cake market is quiet. Prices are holding to schedule. Salt cake is quoted at from $12 to $14 and chrome salt cake at from $12 to $12.50 per ton, at works. Imported salt cake is selling at from $12 to $12.50 per ton, on dock.

SODA ASH.—Conditions in the soda ash market are fairly satisfactory. The contract movement is seasonal. Prices remain unchanged. Quotations on soda ash, in car lots, at works, per 100 pounds, are as follows: in bags, $1.40; and in barrels, $1.50.

STARCH.—The starch market is firm. Shipments against contract are moving at a steady pace. Prices remain unchanged. Special paper making starch is quoted at $3.57 per 100 pounds, in bags; and at $3.84 per 100 pounds, in barrels, at works.

SULPHATE OF ALUMINA.—Trading in the sulphate of alumina market is fairly active. Prices are unchanged. Commercial grades are quoted at from $1.35 to $1.50; while iron free is selling at from $1.90 to $2.05 per 100 pounds, in barrels, at works.

SULPHUR.—The sulphur market is steady. Sulphur is quoted at $18 per long ton on orders of 1,000 tons, or over, on yearly contracts; and at $20 per ton on any smaller quantity over that period. On spot and nearby carloads, the quotation is $21 per ton.

TALC.—Business in the talc market is practically marking time. The contract movement is about average. Domestic talc is quoted at from $16 to $18 per ton, in bulk, at eastern mines; while imported talc is selling at from $23 to $30 per ton, on dock.

Market Quotations

Paper

(F. o. b. Mill)

Ledgers	6.50	@	—
Bonds	6.00	@	—
Index	6.00	@	—
Writings—			
Extra Superfine	6.50	@	—
Superfine	6.25	@	—
Tub sized	5.75	@	—
Engine sized	5.50	@	—
Book, Cased—			
S. & S. C.	5.35	@	5.75
S. & S. C. Litho.	5.60	@	6.00
M. F.	5.10	@	5.50
Coated and Enamel	5.90	@	6.55
Coated Litho	5.90	@	6.55
Tissues—Per Ream—			
White No. 1	.82½	@	.85
White No. 2	.67½	@	—
Anti-Tarnish M. G. only	1.00	@	—
Colored	.85	@	—
Kraft	.70	@	—
Manila	.67½	@	.70
Manila—			
No 1 Jute	9.00	@	9.25
No. 2 Jute	7.75	@	8.50
No. 1 Wood	4.00	@	5.25
No. 2 Wood	3.50	@	4.00
Butchers	4.00	@	4.50
Fibre Papers—			
No. 1 Fibre	4.25	@	5.50
No. 2 Fibre	4.00	@	4.75
Common Bogus	1.50	@	3.00
Screenings	2.50	@	3.50
Glassine—			
Bleached	.11	@	—
Unbleached	.09	@	—

(The following Quotations are Delivered New York)

News, per ton			
Roll, contract	40.00	@	—
Rolls, spot	40.00	@	—
Sheets	45.00	@	—
Kraft—			
No. 1 Domestic	4.75	@	5.00
No. 2 Domestic	3.87½	@	—
Southern	3.87½	@	—
Boards—per ton—			
News	40.00	@	45.00
Chip	37.50	@	40.00
Sgl. Mla. Ll. Chip	47.50	@	52.50
Jute Lined Chip	47.50	@	52.00
White Patent Coated	60.00	@	65.00
Binders Boards	67.00	@	75.00

Mechanical Pulp

(On Dock, Atlantic Ports)

No. 1 Imported—			
Moist	22.00	@	24.00
Dry	23.00	@	24.00
(F.o.b. Mill)			
No. 1 Domestic and Canadian	22.00	@	26.00

Chemical Pulp

(On Dock, Atlantic, Gulf and West Coast Ports)

Bleached Sulphite (Domestic and Foreign)—			
Division 1	2.85	@	—*
Division 2	2.80	@	—*
Division 3	2.75	@	—*
Prime Qualities—			
Class 1. All Prime Easy Bleaching	2.25	@	—*
Other Than Easy Bleaching—			
Class 2. Higher Than Standard	2.20	@	—*
Class 3. Standard	2.15	@	—*
Class 4. Lower than Standard	2.10	@	—
(On Dock, Atlantic Ports)			
Kraft No. 1	1.70	@	1.80
Kraft No. 2	1.55	@	1.65
(F.o.b. Pulp Mill)			
Kraft Domestic	1.60	@	2.25
(Delivered)			
Soda Bleached	2.50	@	—

*Add 60 Cents per short ton, dock charges, for Albany; $2.00 for Lake Ports East and $3.00 for Lake Ports West of Mackinac Straits.

Domestic Rags

New Rags

(Prices to Mill f. o. b. N. Y.)

Shirt Cuttings—			
New White, No. 1	5.75	@	6.00
Silesias No. 1	3.75	@	4.00
New Unbleached	6.25	@	6.50
New Soft Blacks	3.00	@	3.25
Blue Overall	3.50	@	3.75
Fancy	2.50	@	2.75
Washables	1.75	@	2.00
Mixed Khaki Cuttings	3.00	@	3.25
O. D. Khaki Cuttings	3.75	@	4.00
Men's Corduroy	1.50	@	.75
New Mixed Blacks	2.50	@	2.75

Old Rags

White, No. 1—			
Repacked	3.00	@	3.50
Miscellaneous	2.75	@	3.25
White, No. 2—			
Repacked	1.75	@	2.25
Miscellaneous	1.50	@	1.75
Thirds and Blues—			
Repacked	1.50	@	1.75
Miscellaneous	1.25	@	1.50
Black Stockings	2.50	@	3.00
Roofing Rags—			
No. 1	1.10	@	1.25
No. 2	.80	@	.85
No. 3	.70	@	.75
No. 4	.65	@	.70
No. 5A	.60	@	.65

Foreign Rags

New Rags

New Dark Cuttings	1.60	@	1.70
New Mixed Cuttings	1.75	@	1.85
New Light Silesias	3.75	@	4.00
Light Flannelettes	3.75	@	4.00
Unbleached Cuttings	6.50	@	6.75
New White Cuttings	6.50	@	6.75
New Light Oxfords	3.25	@	3.50
New Light Prints	2.75	@	3.00

Old Rags

No. 1 White Linens	7.50	@	8.00
No. 2 White Linens	6.50	@	7.00
No. 3 White Linens	4.50	@	5.00
No. 4 White Linens	2.25	@	2.50
No. 1 White Cotton	4.25	@	4.75
No. 2 White Cotton	3.25	@	3.75
No. 3 White Cotton	2.50	@	2.75
No. 4 White Cotton	1.90	@	2.15
Extra Light Prints	2.00	@	2.25
Ord. Light Prints	1.75	@	1.85
Med. Light Prints	1.55	@	1.65
Dutch Blue Cottons	1.75	@	1.85
French Blue Linens	2.30	@	2.40
German Blue Linens	2.15	@	2.25
German Blue Cottons	1.70	@	1.80
Checks and Blues	1.30	@	1.40
Linsey Garments	1.40	@	1.60
Dark Cottons	1.00	@	1.10
Old Shopperies	.95	@	1.00
New Shopperies	.90	@	1.00
French Blues	1.70	@	1.80

Old Rope and Bagging

(Prices to Mill f. o. b. N. Y.)

Gunny No. 1—			
Foreign	1.50	@	1.60
Domestic	1.40	@	1.50
Wool Tares, light	1.20	@	1.30
Wool Tares, heavy	1.20	@	1.30
Bright Bagging	1.15	@	1.25
Manila Rope			
Foreign	2.35	@	2.45
Domestic	2.25	@	2.50
Small Mixed Rope	1.10	@	1.35
New Burlap Cut	2.00	@	2.25
Hessian Jute Threads—			
Foreign	2.60	@	2.75
Domestic	2.80	@	3.00

Old Waste Papers

(F. o. b. New York)

Shavings—			
White Envelope Cuttings	2.70	@	2.80
Ordinary Hard White No. 1	2.15	@	2.25
Hard White No. 2	1.95	@	2.05
Soft White No. 1	1.85	@	1.95
Flat Stock—			
Stitchless	.80	@	.90
Over issue Mag.	.80	@	.90
Solid Flat Book	.65	@	.75
Crumpled No. 1	.60	@	.65
Solid Book Ledger	1.50	@	1.65
Ledger Stock	1.00	@	1.10
New B. B. Chips	.30	@	.35
Manilas—			
New Env. Cut	1.70	@	1.80
New Cuttings	1.35	@	1.45
Print	Nominal		
Bogus Wrapper	.40	@	.50
Container	Nominal		
Old Kraft Machine—			
Compressed bales	1.10	@	1.20
News—			
No. 1 White News	1.15	@	1.25
Strictly Overissue	.65	@	.70
Strictly Folded	.42½	@	.50
No. 1 Mixed Paper	.32½	@	.40

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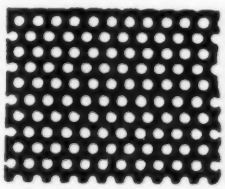

".065" Round

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Twines
(F. o. b. Mill)

Cotton—			
B. C. 18 basis	.20	@	.32
No. 1	.20	@	.22
No. 2	.19	@	.20
No. 3	.17	@	.18
A. Italian, 18 basis	.36	@	.37
Finished Jute—			
Dark, 18 basis	.18	@	.20
Light, 18 basis	.20	@	.22
Jute Wrapping, 3-6 Ply—			
No. 1	.15½	@	.16½
No. 2	.15	@	.16
Tube Rope—			
4-ply and larger	.09¼	@	.09¾
Fine Tube Rope—			
4-ply	.11¾	@	.11¾
3-ply	.14¾	@	.14¾
2-ply	.14¾	@	.14¾
Paper Makers Twine	.08¼	@	.13¾
Box Twine, 2-3 ply	.14¾	@	.14¾
White Hemp	.13¾	@	.16¾
Java Sisal—			
No. 1 Basis	.11½	@	—
No. 2 Basis	.10½	@	—
New Zealand Sisal	.11½	@	—
Sisal Lath Yarn—			
No. 1	.13½	@	.15½
No. 2	.11½	@	.13½
Manila Twine	.24½	@	.29½

CHICAGO

Paper
(F. o. b. Mill)

Rag Bond	.12	@	.50
Water Marked Sulphite Bond	.06¾	@	.11
Sulphite Bond	.05½	@	.11
Superfine Writing	.18	@	.24
No. 1 M. F. Book	.06½	@	.07¼
No. 2 M. F. Book	.05¼	@	.06¼
No. 1 S.&S.C. Book	.06¾	@	.07¾
No. 2 S.&S.C. Book	.05¾	@	.06½
Coated Book	.07	@	.12
Coated Label	.07	@	.08½
No. 1 Manila	.04¼	@	.05¼
No. 1 Fibre	.04¾	@	.05¼
No. 2 Manila	.04½	@	.04¾
Butcher's Manila	.03¼	@	.03¾
No. 1 Kraft	4.75	@	5.00
Southern Kraft	3.88	@	4.25
No. 2 Kraft	3.88	@	4.25
Wood Tag Boards	.04¼	@	.06¾
Sulphite Screenings	.03	@	.03¼
Manila Tissue	.05¾	@	.07
White Tissue	.07	@	.09
(Delivered Central Territory)			
News, per ton—			
Rolls, contract	41.00	@	—
Sheets, open	46.00	@	51.00
Boards, per ton—			
Plain Chip	46.50	@	—
Solid News	50.00	@	—
Manila Lined Chip	55.00	@	—
Patent coated	65.00	@	—
Container Lined—			
85 Test, per 1000 sq. ft.			1.70
100 Test, per 1000 sq. ft.			1.85

Old Papers
(F. o. b. Chicago)

Shavings—			
No. 1 White Envelope cuttings	1.70	@	2.00
No. 1 Hard White	1.40	@	1.65
No. 1 Soft White	1.25	@	1.50
Ledger & Writings	.70	@	.80
Solid Books	.60	@	.70
Blanks	1.00	@	1.05
Krafts	.80	@	.90
New Kraft Cuts	1.20	@	1.30
Manila Env. Cuts	1.25	@	1.30
Ex. No. 1 Manila	.90	@	1.00
Print Manila	.50	@	.55
Overissue News	.60	@	.70
Old Newspapers—			
No. 1	.50	@	.55
Mixed Papers—			
No. 1	.30	@	.35
Roofing Stocks—			
No. 1	30.00	@	—
No. 2	28.00	@	—

PHILADELPHIA

Paper
(Delivered Philadelphia)

Bonds	.05-9/10	@	.38
Ledgers	.06 9/10	@	.40
Writings—			
Fine No. 3	.05	@	.06
Superfine	.10	@	.18
Extra Fine	.15	@	.26
Fine	.15	@	.26
Fine, No. 2	.10	@	.25
Book, M. F.	.05¼	@	.06¼
Book, S. S. & C.	.05	@	.07½
Book, Coated	.06½	@	.09
Coated Lithograph	.06¾	@	.08½
Label	.07	@	.11
No. 1 Jute Manila	6.25	@	—
Manila Sul., No. 1	5.25	@	—
Manila No. 2	3.00	@	—
No. 1 Kraft	5.00	@	—
Southern Kraft	4.75	@	—
Common Bogus	.03	@	.04½
News Print Rolls	46.00	@	55.00
Straw Board	40.00	@	45.00
News Board	50.00	@	—
Chip Board	45.00	@	—
Wood Pulp Board	70.00	@	85.00
Binder Boards—			
No. 1, per ton	75.00	@	80.00
No. 2, per ton	70.00	@	75.00
Carload lots	65.00	@	70.00
Tarred Felts—			
Regular	52.25	@	54.23
Slaters (per roll)	.84	@	.94
Best Tarred, 1-ply (per roll)	1.95	@	2.10
Best Tarred, 2-ply (per roll)	1.50	@	1.65
Best Tarred, 3-ply	2.00	@	2.21

Domestic Rags (New)
(Price to Mill, f. o. b. Phila.)

Shirt Cuttings—			
New White, No. 1.	.03½	@	.04
New White, No. 2.	.02½	@	.04
Light Silesias	.02½	@	.03
Silesias, No. 1	.03	@	.03½
Black Silesias, soft.	.02½	@	.03
New Unbleached	.05	@	.05½
Washable, No. 1	.01½	@	.02
Blue Overall	.03½	@	.04
Cottons—According to grades—			
Washable, No. 2	.02½	@	.03
New Blue	.01½	@	.03
Fancy	.01½	@	.03
New Black Soft	.02	@	.04
New Light Seconds	.01½	@	.02
New Dark Seconds	1.50	@	1.75
Khaki Cuttings—			
No. 1 O.D.	.03	@	.04
No. 2 Mixed	.03	@	.04
Corduroy	.02	@	.03
New Canvas	.03½	@	.04½
New Black Mixed	.02½	@	.03½

Domestic Rags (Old)

White No. 1—			
Repacked	2.50	@	3.50
Miscellaneous	1.75	@	2.25
M. G.	3.00	@	3.75
Thirds and Blues—			
Miscellaneous	1.00	@	1.50
Repacked	1.50	@	2.00
Black Stockings (Export)	2.00	@	3.50
Roofing Stock—			
Foreign No. 1	.50	@	.75
Repacked	.70	@	.85

Bagging
(F. o. b. Phila.)

Gunny, No. 1—			
Foreign	1.25	@	1.50
Domestic	1.50	@	1.75
Manila Rope	2.00	@	2.25
Sisal Rope	1.25	@	1.50
Mixed Rope	1.00	@	1.10
Scrap Burlaps—			
No. 1	1.25	@	1.50
No. 2	.80	@	1.00
Wool Tares, heavy	2.75	@	—
Mixed Strings	1.15	@	1.25
No. 1 New Light Burlap	2.25	@	2.50
New Burlap Cuttings	2.00	@	2.25

Old Papers
(F. o. b. Phila.)

Shavings—			
No. 1 Hard White	2.25	@	2.30
No. 2 Hard White	1.90	@	2.00
No. 1 Soft White	1.80	@	1.85
No. 2 Soft White	1.25	@	1.30
No. 1 Mixed	—	@	.75
Solid Ledger Stock	1.50	@	1.60
Writing Paper	1.10	@	1.20
No. 1 Books, heavy	.65	@	.70
No. 1 New Manila	1.35	@	1.40
Print Manila	.50	@	.60
Container Manila	.45	@	.50
Old Kraft	1.15	@	1.20
No. 1 Mixed Paper	.32½	@	—
Straw Board Chip	.30	@	—
Binders Board Chip	.30	@	—
Corrugated Board	.50	@	—
Overissue News	.60	@	—
Old Newspapers	.42½	@	—

BOSTON

Paper
(F. o. b. Mill)

Ledgers—			
Sulphite	.06	@	.12½
Rag Content	.12	@	.30
All Rag	.36	@	.52½
Bonds—			
Sulphite	.07¼	@	.11
Rag Content	.12	@	.30
All Rag	.36	@	.65
Writings	.06½	@	.20
Superfines	.11	@	.31
Book, Super	.06	@	.09
Book, M. F.	.05½	@	.08½
Book, Coated	.08½	@	.18
Coated Litho	.09	@	.12
Label	.09½	@	.15
Jute Manila No. 1	.11	@	.13
Manila, Sul. No. 1	.04¾	@	.06¾
Manila, Sul. No. 2	.03¾	@	.04½
No. 1 Kraft	.04¾	@	.05
No. 2 Kraft	.03½	@	.04½
(F. o. b. Boston)			
Southern Kraft	.03½	@	.04½
(F. o. b. destination in carload lots, f. o. b. mill in less than carload lots.)			
Common Bogus	.02	@	.02¾
(Delivered New England points)			
News Print, rolls	44.50	@	—
Straw Board, rolls	.009	—	@35.00
Straw Board in Sheets, basis 35s to 70s	—	@40.00	
Filled News Board	40.00	@45.00	
Chip Board	37.50	@40.00	
Chip Board (Creasing)	37.50	@40.00	
Single Manila Lined Chip	47.50	@52.50	
Single White, Patent Coated News Board (Bender)	57.50	@65.00	
Wood Pulp Board	70.00	@75.00	
Binder Boards (Standard Grade)	67.00	@75.00	

Old Papers
(F. o. b. Boston)

Shavings—			
No. 1 Hard White	$2.20	@	2.35
No. 1 Soft White	1.75	@	2.00
No. 2 Mixed	.80	@	.85
Solid Ledger Books	1.75	@	—
Overissue Ledger Stock	1.15	@	1.30
Mixed Ledgers	.95	@	1.05
No. 1 Books, heavy	.85	@	.90
No. 1 Books, light	.65	@	.75
Crumpled Stitchless Book Stock	.50	@	.60
Manila Env. Cuttings	1.25	@	1.30
No. 1 Old Manila	.65	@	.70
White Blank News	1.10	@	1.15
No. 1 Kraft	1.05	@	1.10
Manila	.55	@	.60
No. 1 Mixed Papers	.35	@	—
Print Manila	.45	@	.50
Overissue News	.50	@	.55
Old Newspapers	.45	@	—
Box Board Chips	.32½	@	.35
Corrugated Boxes	.40	@	.42½
Screening Wrappers	.50	@	.60

Bagging
(F. o. b. Boston)

Manila Rope—			
Foreign	—	@	1.75
Domestic	1.90	@	2.00
Transmission Rope	.90	@	1.00
Mixed Strings	.40	@	—
Jute Rope	1.35	@	1.40
Jute Carpet Threads	.65	@	.70
Gunny No. 1—			
Foreign	1.50	@	1.60
Domestic	1.25	@	—
Bleachery Burlap	4.00	@	4.50
Scrap Burlap	1.05	@	1.10
Scrap Sisal	1.10	@	1.20
Scrap Sisal for shredding	1.00	@	1.25
Wool Tares, heavy	1.25	@	1.30
New Burlap Cuttings	1.45	@	1.50
Australian Wool Pouches	2.00	@	2.25
Heavy Baling Bagging	1.40	@	1.50
Paper Mill Bagging	.90	@	1.10
Bagging No. 2	.50	@	.55

Domestic Rags (New)
(F. o. b. Boston)

Shirt Cuttings—			
New Light Prints	.01¾	@	.02
New White No. 1.	.05½	@	.06
New White No. 2.	.03½	@	.04
Silesias No. 1	.04	@	—
New Black Silesias	.02½	@	.03
New Unbleached	.05½	@	.06
Blue Cheviot	—	@	4.65
Fancy	—	@	.03½
Washable	.02¼	@	—
Cottons—According to grades—			
Blue Overalls	—	@	.03½
New Black, soft	.04	@	.04½
Khaki Cuttings	.03	@	.03¼
O. D. Khaki	.02¾	@	.03
Corduroy	.01¾	@	.02
New Canvas	—	@	.05
B.V.D. Cuttings	—	@	.06¼

Domestic Rags (Old)
(F. o. b. Boston)

Canvas	.04½	@	—
White No. 1—			
Repacked	—	@	3.00
Miscellaneous	2.50	@	2.75
White No. 2—			
Repacked	2.00	@	2.75
Miscellaneous	2.00	@	2.25
Twos and Blues	1.25	@	1.50
Thirds and Blues			
Repacked	2.00	@	2.75
Miscellaneous	2.00	@	2.25
Black Stockings	2.25	@	2.50
Roofing Stock			
No. 1	.70	@	.75
No. 2	.65	@	.70
No. 3	.55	@	.60

Foreign Rags
(F. o. b. Boston)

Dark Cottons	.85	@	.95
New White Shirt Cuttings	5.50	@	6.00
Dutch Blues	2.00	@	2.50
New Checks & Blues	2.50	@	3.00
Old Fustians	1.55	@	1.60
Old Linsey Garments	1.25	@	1.35

TORONTO

Paper
(F. o. b. Mill)

Bond—			
No. 1 Sulphite	.10¼	@	—
No. 2 Sulphite	.08½	@	—
No. 1 Colored	.10¼	@	—
No. 2 Colored	.09	@	.10
Ledgers (sulphite)			
Ledgers, No. 1	.34½	@	—
Ledgers, No. 2	.25½	@	—
Writing	.09	@	.09½
Book—			
No. 1 M. F. (Carloads)	6.20	@	—
No. 3 M. F. (Carloads)	5.70	@	—
No. 4 M. F. (carloads)	4.75	@	—
No. 1 S. C. (carlo	6.65	@	—
No. C. (carlo	6.20	@	—
No. C. (carloads)	5.20	@	—
No. 1 Coated and Litho	12.00	@	—
No. 2 Coated and Litho	10.50	@	—
No. 3 Coated and Litho	9.50	@	—
Coated tinted	14.00	@	—
Wrapping—			
Rag Brown	4.25	@	—
White Wrap	2.22½	@	—
"B" Manila	4.75	@	—
No. 1 Manila	5.25	@	—
Fiber	5.25	@	—
Kraft, M. F.	5.75	@	—
Kraft No. 2	5.25	@	—
(F.O.B. Cars Toronto)			
News, per ton—			
Rolls (contract)	45.50	@	—
Sheets	50.50	@	—

Pulp
(F. o. b. Mill)

Ground Wood	18.00	@20.00	
Sulphite easy bleaching	40.00	@ —	
Sulphite, news grade	38.00	@ —	
Sulphite, bleached	50.00	@55.00	
Sulphate	50.00	@ —	

Old Waste Paper
(In carload lots, f. o. b. Toronto)

Shavings—			
White Env. Cut	2.00	@	2.30
Soft White	1.60	@	1.90
White Blk. News	1.25	@	1.40
Book and Ledger—			
Flat Magazine and Book Stock (old)	.90	@	1.00
Light and Crumpled Book Stock	.80	@	.90
Ledgers and Writings	1.00	@	1.05
Manilas—			
New Manila Cut	1.25	@	1.50
Printed Manilas	.70	@	.60
Kraft	1.25	@	1.50
News and Scrap—			
Strictly Overissue	.80	@	—
Strictly Folded	.60	@	—
No. 1 Mixed Paper	.50	@	—

Domestic Rags
(Price to mills, f. o. b. Toronto)

No. 1 White Shirt Cuttings	.06	@	.06¼
Fancy Shirt Cuttings	.02¼	@	.02½

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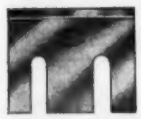
SILVER STEEL MACHINE KNIVES



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Cass, West Virginia

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CLASSIFIED ADVERTISEMENTS—4c a word. Double rate for heavy face type. Minimum charge $1.00.

All classified "Help Wanted" and "Situation Wanted" advertisements are payable in advance.

HELP WANTED

SALARIED POSITIONS. $2,500 to $25,000. This thoroughly organized advertising service of 24 years' recognized standing and reputation carries on preliminary negotiations for positions of the calibre indicated, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If you have actually earned over $2,500, send only name and address for details. R. W. Bixby, Inc., 117 Delward Bldg., Buffalo, N. Y.

WANTED—Machine Tenders, Back Tenders. Toilet Tissue plain and crepes. Steady work. No lost time. Address Box 34-414, care Paper Trade Journal. S-20

WANTED—Man not over 35 years of age, married, who is experienced in printing, waxing and rewinding of papers to be trained for Assistant Superintendent job in our plant. Give reference, past experience, personal qualifications, photograph, and if employed. Address Box 34-413, care Paper Trade Journal. S-20

SITUATIONS WANTED

CYLINDER MACHINE TENDER wants position. 20 years' experience on Combination-board. Specialties and Container-liner. Can furnish first class references. Address Box 34-390, care Paper Trade Journal. S-27

BOARD MILL SUPERINTENDENT—A-1 manufacturer of high grade box boards, white patent coated, butter cartons, wall board, and specialties. Expert colorman, beater room specialist. Perfect maintainence at low costs. Highest references guaranteed. Address Box 34-398, care Paper Trade Journal. O-11

SUPERCALENDER FOREMAN—Eighteen years' experience. Well up on finishes and repairs. Good organizer. Can get results. Address Box 34-418, care Paper Trade Journal. S-20

FINISHING ROOM FOREMAN and shipping clerk experienced on all grades of box board and specialties, cutters, rewinders and pasting machines. Reliable references. Address Box 34-417, care Paper Trade Journal. O-4

CHEMICAL ENGINEER—Four years successful laboratory research experience along paper, pulp and allied lines. Solved a number of important problems. Four years' experience as Plant Chemist including Glassine, Greaseproof and Waxing Papers. Further details gladly furnished upon request. Address Box 34-428, care Paper Trade Journal. S-27

RECENT PULP and Paper Graduate—With laboratory and finishing room experience and semi-commercial work in all phases pulp, paper manufacture, desirous of connection wherein ability may be utilized. Address Box 34-416, care Paper Trade Journal. S-27

PRACTICAL Kraft Mill Superintendent. Twenty-two years' experience on Bag Wrappers and Specialties. A-1 on Maintenance and can get efficiency and results. Address Box 34-415, care Paper Trade Journal. O-4

SITUATIONS WANTED

BOARD MILL SUPERINTENDENT — 45 years old. Married. 25 years experience all grades folding box and specialties. Production quality and mill maintenance guaranteed. Address Box 34-283, care Paper Trade Journal. S-27

PLANT ENGINEER with wide experience in design, construction, maintenance and operation of pulp and paper mill desires new position. Address Box 34-400 care Paper Trade Journal. O-4

WANTED—Position as MANAGER or SUPERINTENDENT of mill making binders, leather and other boards. Middle aged man. Good at construction and repairs. Address A. Martin, 100 Lancaster Ave., Downingtown, Pa. S-27

RECENT COLLEGE GRADUATE in pulp and paper engineering desires employment with paper converting establishment. Salary secondary consideration to future possibilities. Best references. Address Box 34-401, care Paper Trade Journal. S-27

EXPERIENCED in distribution of fine and coarse papers and specialties. Want to represent high grade specialty mill or mill agency in Chicago and Middle West. Address Box 34-402, care Paper Trade Journal. S-20

POSITION WANTED—SUPERINTENDENT OR FOREMAN; chip board or wrapping mill. Experienced at construction or remodeling. Eastern States preferred. Address A. Martin, 100 Lancaster Ave., Downingtown, Pa. S-27

WANTED

WANTED—One Kamyr Wet Machine for producing air dry pulp. Address Box 34-427, care Paper Trade Journal. S-20

WANTED—Used Paper Bag Machines for Flat and square bags. Address Box 34-420, care Paper Trade Journal. S-20

WANTED—Several Biggs 14' diameter rotary digesters. Address Box 34-419, care Paper Trade Journal. S-20

MISCELLANEOUS

CLARK MANUFACTURING COMPANY, Holyoke, Mass. Telephone 2-4370. Builders of cylinder moulds, couch and felt rolls, dandy rolls. We cover dandies and cylinders tight for fast running machines. tf.

Address Replies

to advertisements appearing under Box Numbers in care of

PAPER TRADE JOURNAL

15 West 47th Street
New York, N. Y.

FOR SALE

PAPER COATING MACHINERY—Waxing, Oiling, Gumming, Gluing, Asphalt Duplexing, Laboratory Coating and Treating machines. High speed. New improvement. MAYER COATING MACHINES COMPANY, INC., Rochester, N. Y. T.F.

CORRUGATED PAPER FRUIT & VEGETABLE BASKETS, HAMPERS, ALSO WASTE BASKETS, (patented). All sizes. Tested strength. Ask for sketch. Royalty on basis. Address Box 34-363, care Paper Trade Journal. S-27

FOR SALE—4—350 H.P. 175 lb. Sterling Boilers with super heaters; 1—Noble & Wood Mammoth Jr. jordan engine; 3—150 H.P. Allis-Chalmers double end motors, 3 phase, 60 cycle, 440 volts; 1—Cylinder paper machine molds 36 x 83, 2 presses, 57 dryers 36 x 72; 4—16 plate Packer screen; 59—Dryers 36 x 87; 4—Shartle Stock Pumps; 1—4" Oster pipe machine; 1—2 spindle McCabe lathe 20' bed; 1—Koegel slitter grinder. Address Box 34-411, care Paper Trade Journal. S-20

FOR SALE—Complete modern 134" Rice, Barton & Fales Fourdrinier Paper Machine, trimming 126". Production 50 to 60 tons 24 hours. For full particulars address Box 34-425, care Paper Trade Journal. S-20

FOR SALE—Two Nash Hytor Vacuum Pumps, #4 and #6. The #4 is belt driven from a 25 H.P., 3 phase, 60 cycle, 1,200 r.p.m. G. E. Motor. Both in fine condition. Address Box 34-426, care Paper Trade Journal. S-20

PATENT FOR SALE—An experimental machine, small in size, will press a pulp box in one operation, 5¼ x 8½ x 10". Coming method of box making. Address Chas. H. Wood, 420 17th, Oakland, Cal. O-4

FOR SALE—Two good used Toilet Paper Perforators. One 81" Dietz, equipped to perforate sheets both 4½" and 5" in length and slit 4½" wide. One 76½" three shaft Hudson Sharp, perforates 5" in length by 4½" wide. Address Box 34-423, care Paper Trade Journal. S-20

FOR SALE—1—Two Cylinder Impco multistage washer, used only short time. Molds 42 x 110". Address Box 34-422, care Paper Trade Journal. O-4

FOR SALE—The following Kidder, roll-product Rotary Press: One color 36" x 48"; two color 42" x 48"; three color 36" x 48". Also three color Kidder, roll to sheet delivery, size 32" x 57"; also one three color Meisel Adjustable Rotary, size 36" x 48"; cuts sheets from 18" to 36", by ¼". Address Box 34-421, care Paper Trade Journal. S-20

FOR SALE—50" Saybold Paper Cutter latest type machine, practically new. Address Box 34-114, care Paper Trade Journal. S-20

FOR SALE

New Cylinder Paper Machine—Molds 36' x 91". 4 Baby Presses. 1 Primary Press. 3 Main presses with rolls 20" x 93". 32 Dryers 48" x 88". 2 stacks of calenders Pusey & Jones Fourdrinier Paper Machine. Wire 104" by 65'. Three sets presses. 30 Dryers 48" by 102". English reel.

FRANK H. DAVIS COMPANY

175 Richdale Ave. Cambridge, Mass.
TF

FOR SALE

FOR SALE—1—Mill with single fourdrinier machine, trim 80". Concrete and brick buildings. Well located. Address Box 34-406, care Paper Trade Journal. O-4

FOR SALE—Complete mill with two fourdrinier machines, trim over 100". Address Box 34-407, care Paper Trade Journal. S-27

Classified Advertising Brings Results

FOR SALE

FOR SALE—Bag Making Machine. Prints one or two colors from paper rolls, bag size 4¼" (variable) by 7". Bag suitable for packing cigar clippings, scrap chewing, etc. Address Box 34-403, care Paper Trade Journal. S-20

FOR SALE CHEAP—One used No. 400C Columbus Automatic Stoker. Will feed a 70 to 100 horsepower boiler. In need of repairs. Replaced by larger stoker. Address Box 34-404, care Paper Trade Journal. O-4

FOR SALE—One Vierengel interfolding towel machine. Two wide. 26" single fold, standard length towels 10¾". Re-conditioned and complete. Address Box 34-424, care Paper Trade Journal. S-20

FOR SALE

FOR SALE—4—Bird Screens; 1—112" fourdrinier machine; 75—Dryers 36 x 84, almost new. Address Box 34-408, care Paper Trade Journal. O-4

FOR SALE—2—Bird Screens; Calender Rolls, approximately 12 x 117"; Oliver save-all; Pony Jordan; Parry Liner. Address Box 34-409, care Paper Trade Journal. S-20

FOR SALE—2—Fourdrinier Machines, complete; 1—Hamblet Cutter; 1—Seybold Ream cutter; 1—75" super-calender stack; 1—Beloit English type reel, 132". Address Box 34-410, care Paper Trade Journal. S-27

Asten Felts
Asten-Hill Mfg. Co., Phila.

PULP MILL MACH'Y FINISHING ROOM MACH'Y
— FRICTION CLUTCHES —
The MOORE & WHITE CO.
PHILADELPHIA, PA.
N. PHILA. STA. PENNA. R.R.
PAPER MILL MACHINERY

JOHNSON & WIERK, INC.
PULP AND PAPER MILL ENGINEERS
Grand Central Terminal Bldg., NEW YORK, N. Y.
246 Stuart Street, BOSTON, MASS.

HUDSON SHARP Machine Company
DEPT. J
Green Bay . . . . . Wisconsin
MANUFACTURERS OF THE MOST MODERN AND COMPLETE LINE OF PAPER CONVERTING MACHINERY IN THE WORLD. YOUR INQUIRIES ARE RESPECTFULLY SOLICITED.

INTERNATIONAL WIRE WORKS
Fourdrinier Wires
MENASHA, WISCONSIN

Your Card in This Space Will Bring Results

Appleton Wires are good wires
APPLETON WIRE WORKS INC., APPLETON, WIS.

PERFORATED METAL SCREENS
MADE SPECIALLY FOR PAPER and PULP MILL USE
Copper, bronze, steel or other metals. Heat-treated.
HENDRICK MFG. CO.
60 Dundaff St., Carbondale, Pa
Offices in Principal Cities

Your Card in This Space Will Bring Results

PERFECTION GUMMED PAPERS
All that the Name Implies
"THEY ARE ABSOLUTELY FLAT"
ASK FOR SAMPLE BOOK WITH COMPLETE DATA AND PRICES
PAPER MANUFACTURERS CO. INC.
PHILADELPHIA, PA.

WHERE TO BUY

ABRASIVES
Carborundum Co.
The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.
Norton Co.

ACIDS (Sulphuric)
American Cyanamid & Chem. Corp.
Pennsylvania Salt Co.

ADDING MACHINE ROLLS
Paper Manufacturers Co., Inc.

ADHESIVE APPLYING MACHINES
Potdevin Machine Co.
John Waldron Corp.

AGITATORS
Carthage Machine Co.
Dilts Machine Works, Inc.
Downingtown Mfg. Co.
Hauser Stander Tank Co.
Moore & White Co.
Valley Iron Works Co.

AIR CONDITIONING EQUIPMENT
Ross Engrg. Corp., J. O.
Thwing Instrument Co.
Westinghouse Electric & Mfg. Co.

AIR DRYING MACHINERY
Waldron, John, Corp.

AIR PREHEATING UNITS
Ross Engineering Corp., J. O.

ALLOYS
American Sheet & Tin Plate Co.
Chromium Corporation of America
Electro-Alloys Co., The
Illinois Steel Co.
International Nickel Co.
Kropp Forge Co.
Pusey and Jones Corp.

ALUM
American Cyanamid & Chemical Corp.
Paper Makers Chemical Corp.
Pennsylvania Salt Mfg. Co.

AMMONIA
American Cyanamid & Chem. Corp.
Mathieson Alkali Works, Inc.
Pennsylvania Salt Co.

ARCHITECTS AND ENGINEERS
Ferguson, Hardy S.
Hardy, George F.
Joa, Inc., Curt G.
Johnson & Wierck

ARMORING FLOOR
Hendrick Mfg. Co.

ASBESTINE PULP
International Pulp Co.

AUTOMATIC WATER FEEDER
Merritt Engineering & Sales Corp., The

BACKING WIRES
Appleton Wire Works
International Wire Works

BAG MACHINES
Heinrich Inc., H. H.
Potdevin Machine Co.
Smith & Winchester Mfg Co.

BALERS
Ohio Cultivator Co.

BARKERS
Carthage Machine Co.
Valley Iron Work Co.

BARS (Beater)
International Nickel Co.

BEARINGS
Chain Belt Co.
Link-Belt Co.
Montague Machine Works
S. K. F. Industries
The Manhattan Rubber Mfg. Co.
Timken Roller Bearing Co.
Westinghouse Electric & Mfg. Co.

BEATERS
The Appleton Machine Co.
Dilts Machine Works, Inc.
Emerson Manufacturing Co.
Jones & Sons Co., E. D.
Shartle Bros. Mch. Co.
Valley Iron Works Co.

BEATER BED PLATES
Bolton & Sons, Inc., John W.
Dayton Globe Iron Works
Dilts Machine Works, Inc.
E. D Jones & Sons Co.
Taylor, Stiles & Co.
Valley Iron Works Co.

BEATER CONTROLS
Thwing Instrument Co.

BEATER ENGINE BARS
Bolton & Sons, Inc., John W.
Dayton Globe Iron Works
Dilts Machine Works, Inc.
E. D. Jones & Sons Co.
Taylor Stiles & Co.
Valley Iron Works Co.

BEATER HOODS
Dilts Machine Works, Inc.
E. D. Jones & Sons Co.

BEATER ROLLS
Dayton Globe Iron Works
Dilts Machine Works, Inc.
Emerson Manufacturing Co.
E. D. Jones & Sons Co.

BEATER STOCK RECORDER
Bristol Co., The
Merritt Engineering & Sales Corp., The

BELTING
Goodrich Rubber Co.
Goodyear Tire & Rubber Co.
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan Inc.
Rhoads Sons, J. E.
U. S. Rubber Co.

BELT LACING
Flexible Steel Lacing Co.

BLEACH EJECTORS
Perkins & Sons, Inc., B. F.

BLEACHING APPARATUS
E. D. Jones & Sons Co.
Moore & White Co.

BLEACHING POWDER
Mathieson Alkali Works, Inc.
Pennsylvania Salt Co.

BLEACHING PROCESS
Electro Bleaching Gas Co.
Pennsylvania Salt Mfg. Co.

BLOW PIPING
Moore & White Co.

BLOW PITS
Hauser Stander Tank Co.
Kalamazoo Tank & Silo Co.

BLOWERS (CENTRIFUGAL)
De Laval Steam Turbine Co.
General Electric Co.
Ross Engineering Corp., J. O.
Sturtevant Co., B. F.

BOILER PRESERVATIVES
Magnus Chemical Co.

BOTTOMS (Steel & Wood)
Hauser Stander Tank Co.
Kalamazoo Tank & Silo Co.

BRASS COLLAPSIBLE SHAFTS
Moore & White Co., The

BREAKER BEATER WATER FEEDER
Merritt Engineering & Sales Corp., The

BUCKETS (elevating)
Chain Belt Co.
Hendrick Mfg. Co.
Link-Belt Co.

BULKERS (Pressure)
B. F. Perkins & Son, Inc.

BUNDLING PRESSES
Paper Converting Machine Co., Inc.
Potdevin Machine Co.

BURSTING TESTERS
E. J. Cady & Co.
B. F. Perkins & Son Co.
Testing Machines, Inc.

CALCIUM HYPOCHLORITE
Mathieson Alkali Works, Inc.
Pennsylvania Salt Mfg. Co.

CALENDERS
Beloit Iron Works
Farrel-Birmingham Co.
Lobdell Car Wheel Co.
Moore & White Co.
Norwood Engrg. Co.
Perkins & Son, Inc., B. F.
Smith & Winchester Mfg. Co.
Textile Finishing Mchy. Co.

CALENDER DOCTORS
Dillon Machine Co.
Ticonderoga Machine Works

CALENDER ROLL GRINDERS
Farrel-Birmingham Co.
Lobdell Car Wheel Co.
Smith & Winchester Mfg. Co.
Ticonderoga Machine Works

CALENDER ROLLS
Farrel-Birmingham Co.
Lobdell Car Wheel Co.
Perkins & Son, Inc., B. F.
Smith & Winchester Mfg. Co.
Textile Finishing Mchy. Co.
Waldron, Corp., John

CALIPERS (Micrometer Roll)
Farrell-Birmingham Co.
Lobdell Car Wheel Co.

CAMERAS (Photomicrographic)
Bausch & Lamb Optical Co.

CARBON BISULPHIDE
Pennsylvania Salt Co.

CASEIN
American Cyanamid & Chemical Corp.
The Casein Manufacturing Co. of America
Paper Makers Chemical Corp.

CASTINGS
Carthage Machine Co.
Chain Belt Co.
International Nickel Co.
Farrel-Birmingham Co.
Frederick Iron and Steel Co.
Lobdell Car Wheel Co.
Montague Machine Co.
Smith & Winchester Mfg. Co.
Pusey and Jones Corp.

CASTINGS (Brass, Bronze, Iron)
Smith & Winchester Mfg. Co.

CASTING (Chrome Nickel Alloy)
The Electro-Alloys Co.
Lobdell Car Wheel Co.

CASTINGS (Iron)
Chain Belt Co.
Hamblet Machine Co.
Link-Belt Co.

CAUSTIC SODA
American Cyanamid & Chemical Corp.
Mathieson Alkali Works, Inc.
Paper Makers Chemical Corp.
Pennsylvania Salt Mfg. Co.

CELLOPHANE ADHESIVES
Arabol Manufacturing Co.

CELLULOSE BAG MACHINERY
Potdevin Machine Co

CENTRIFUGAL MACHINERY (Special)
De Laval Steam Turbine Co.

CHAIN DRIVES
Chain Belt Co.
Link-Belt Co.

CHEMICALS
American Cyanamid & Chemical Corp.
Campbell & Co., John
E. I. DuPont de Nemours & Co., Inc.
Electro Bleaching Gas Co.
General Chemical Co.
General Dyestuff Corp
Geigy Co., Inc.
New York Color & Chemical Co., Inc.
Paper Makers Chemical Corp.
Williams & Co., C. K.

CHIPPERS
Carthage Machine Co.
Valley Iron Works Co.

CHLORINE
Electro Bleaching Gas Co.
Mathieson Alkali Works, Inc.
Pennsylvania Salt Co.

CHROME PLATE
Chromium Corporation of America

CHUCKS
John Waldron Corp.

CLAY
American Cyanamid & Chemical Corp.
Ashcraft Wilkinson Co.
English China Clays Sales Corporation
Paper Makers Importing Co.
Vanderbilt Co., R. T.

CLEANING MATERIALS
Magnus Chemical Co.

CLUTCHES
Chain Belt Co.
Link-Belt Co.
Moore & White Co.
Pusey and Jones Corp.

CLUTCH PULLEYS
Moore & White Co.

COATING MACHINERY
Moore & White Co.
Potdevin Machine Co.
Waldron Corporation, John

COATING MATERIALS
National Oil Products Co.
Paper Makers Chemical Corp.

COCKS, Lubricated
Crane Company

COGS
Bowsher, N. P., The
Dayton Globe Iron Works

COLLAPSIBLE WINDER SHAFTS
Moore & White Co.

COLORIMETERS
Bausch & Lomb Optical Co.

COLOR ANALYZERS
Thwing Instrument Co.

COLOR MIXING EQUIPMENT
Waldron, John, Corp.

COMBINING MACHINES
Waldron Corp., John

COMPRESSORS (Air)
Allis-Chalmers Mfg. Co.
General Electric Co.

COMPRESSORS (Centrifugal)
De Laval Steam Turbine Co.

CONSISTENCY REGULATOR
Merritt Engineering & Sales Corp., The
Trimbey Machine Works

CONTINUOUS BEATER ATTACHMENTS
E. D. Jones & Sons Co.

CONTINUOUS BEATERS
E. D. Jones & Sons Co.
Valley Iron Works Co.

CONTINUOUS BEATER WATER FEEDER
Merritt Engineering & Sales Corp., The
Trimbey Machine Works.

CONTROLLING INSTRUMENTS
Bristol Co., The
Merritt Engineering & Sales Corp., The
Testing Machines, Inc.
Thwing Instrument Co.

CONTROLS (Electric)
Thwing Instrument Co.

CONVEYOR CHAINS
Chain Belt Co.
Link-Belt Co.

CONVEYORS (Trim)
Link-Belt Co.
Ross Engineering Corp., J. O.

COOKING & RECOVERY PROCESS
Chemipulp Process, Inc.
Ross Engineering Corp., J. O.

CORES (Paper)
Climax Tube Co.
Elixman Paper Co.

CORES (Steel)
Smith & Winchester Mfg. Co.

COTTON CALENDER ROLLER
Perkins & Son, Inc., B. F.
Textile Finishing Mchy. Co.

COUCH ROLLS
American Wringer Co.
Beloit Iron Works
Goodrich Rubber Co., B. F.
Montague Machine Co.
Moore & White Co., The
The Manhattan Rubber Mfg Division of Raybestos-Manhattan, Inc.
Pusey and Jones Corp.

COUPLINGS
Chain Belt Co.
De Laval Steam Turbine Co.
Frederick Iron and Steel Co.
Waldron Corp., John
Walworth Co.
Westinghouse Electric & Mfg. Co.

CREPING MACHINES
Beloit Iron Works
Paper Converting Machine Co., Inc.
John Waldron Corp.

CYLINDER RAILROAD AND DEVIL DUSTER
Moore & White Co.

CYLINDER DRIVES
Moore & White Co., The

CYLINDER MOULDS
Beloit Iron Works
Carthage Machine Co.

CYLINDER WIRES
Appleton Wire Works
International Wire Works

WHERE TO BUY

DAMPENERS
Perkins & Son, Inc., B. F.
DECKERS
Carthage Machine Co.
Montague Machine Co.
Oliver United Filters Inc.
Valley Iron Works
DEFOAMERS
Campbell & Co., John
National Oil Products Co.
DENSITY REGULATOR
Merritt Engineering & Sales Corp., The
DEXTRINES
Arabol Manufacturing Co.
DIE CUTTERS
Appleton Machine Co., The
DIGESTERS
Pusey & Jones Corp.
DIGESTER FITTINGS
The Electro-Alloys Co.
DOCTOR BLADES
Goodrich Rubber Co., B. F.
International Nickel Co.
The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.
DRIVE STANDS
Beloit Iron Works
Moore & White Co.
Pusey and Jones Corp.
DRIVES (Paper Machinery)
Beloit Iron Works
Chain Belt Co.
Farrel-Birmingham Co.
Link-Belt Co.
Pusey & Jones Corp.
Westinghouse Electric & Mfg Co.
DRYING SYSTEMS
Pickles, W. F.
Ross Engineering Corp., J. O.
Waldron Corporation, The
DUSTING MACHINERY
Carthage Machine Co.
Jones & Sons Co., E. D.
Moore & White Co.
DYESTUFFS & COLORS
Campbell & Co., John
E. I. DuPont de Nemours & Co.
General Dyestuff Corp.
Heller & Merz
Geigy Co., The
National Aniline & Chemical Co.
New York Color & Chemical Co., Inc.
United Color & Pigment Co.
C. K. Williams & Co.
ELECTRIC EQUIPMENT
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.
ELEVATORS
Chain Belt Co.
EMBOSSING CALENDERS
Perkins & Sons, Inc., B. F.
Textile Finishing Machinery
EMBOSSING MACHINES
Hudson Sharp Machine Co.
Paper Converting Machine Co.
John Waldron Corp.
EMBOSSING ROLLS
The Appleton Machine Co.
Hudson Sharp Machine Co.
B. F. Perkins & Son, Inc.
Textile Finishing Mchy. Co.
Waldron Corporation, John
EXHAUST FANS
Propellair, Inc.
EXTRACTORS
Downingtown Manufacturing Co.
Valley Iron Works Co.
FANS
E. D. Jones & Sons Co.
B. F. Perkins & Son, Inc.
Propellair, Inc.
Ross Engineering Co., J. O.
Sturtevant Co., B. F.
FAN PUMPS
Beloit Iron Works
Carthage Machine Co.
Moore & White Co.
Pusey and Jones Corp.
Valley Iron Works Co.
Smith & Winchester Mfg. Co.
FELT CARRIER ROLLS
American Wringer Co.
Beloit Iron Works
Goodrich Rubber Co., B. F.
Pusey and Jones Corp.
FELT CLEANERS
Magnus Chemical Co.
FELTS AND JACKETS
Appleton Woolen Mills
Austen-Hill Mfg. Co.
Bulkley, Dunton & Co.
Draper Bros. Co.
Fitchburg Duck Mills
Huyck & Son, E. C.
Knox Woolen Co.
Lockport Felt Co.
Orr Felt & Blanket Co.
Philadelphia Felt Co.
Shuler & Benninghofen
Turner, Halsey Co.
Waterbury Felt Co.
FELT GUIDES
Moore & White Co.
FELT SOAPS
Magnus Chemical Co.
FELT TIGHTENER (Automatic)
John Waldron Corp.
Pusey and Jones Corp.
FILLINGS (Jordan)
International Nickel Co.
FILTERS
Moore & White Co.
Norwood Engrg. Co.
Oliver United Filters Inc.
J. O. Ross Engrg. Corp.
FILTER CLEANERS
Magnus Chemical Co.
FILTER WIRES
Appleton Wire Works
FITTINGS (Pipe)
Crane Company
FLANGES
Crane Company
Walworth Co.
FLAT SCREENS
The Appleton Machine Co.
Beloit Iron Works
Downingtown Mfg. Co.
FLEXIBLE COUPLINGS
Chain Belt Co.
De Laval Steam Turbine Co.
Emerson Manufacturing Co.
Frederick Iron & Steel Co.
Link-Belt Co.
John Waldron Corp.
FLEXIBLE SLICE
E. D. Jones & Sons Co.
FLEXIBLE STEEL LACING
Flexible Steel Lacing Co.
FLOOR TILE (Non-Slip)
Carborundum Co.
Norton Co.
FLOW METER
General Electric Co.
FLY BARS
Bolton & Sons, Inc., John W.
Dilts Machine Works, Inc.
Jones & Sons Co., E. D.
FOLDING ENDURANCE TESTERS
Testing Machines, Inc.
FOLDING MACHINES
Dillon Machine Co.
Hamblet Machine Co.
Hudson Sharp Machine Co.
Curt G. Joa, Inc.
Paper Converting Machine Co., Inc.
Waldron, John, Corp.
FORGINGS (Drop & Hammer)
Kropp Forge Company
FOURDRINIER WIRES
Appleton Wire Works
International Wire Works
FREENESS RECORDERS
Trimbey Machine Works
FREENESS TESTERS
Testing Machines, Inc.
FRICTION CALENDERS
Perkins & Son, Inc., B. F.
Textile Finishing Mchy. Co.
FRICTION CLUTCHES
Beloit Iron Works
Link-Belt Co.
Moore & White Co
Pusey and Jones Corp.
GATES
Dayton Globe Iron Works
GEARS
Chain Belt Co.
Farrel-Birmingham Co.
Dayton Globe Iron Works
De Laval Steam Turbine Co.
E. D. Jones & Sons Co.
Link-Belt Co.
Moore & White Co.
Sturtevant Co., B. F.
Pusey and Jones Corp.
John Waldron Corp.
GENERATORS
De Laval Steam Turbine Co.
General Electric Co.
GLUES
Arabol Manufacturing Co.
GRANITE ROLLS
Beloit Iron Works
Perkins & Sons, Inc., B. F.
Pusey and Jones Corp.
GRATING (Sidewalk)
Hendrick Mfg. Co.
GRINDERS
Carthage Machine Co.
Montague Machine Co.
GRINDING WHEELS
E. C. Atkins & Co.
Carborundum Co.
Norton Co.
The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.
GUIDES (Automatic Web)
John Waldron Corp.
GUIDES (FELT)
Moore & White Co.
GUMMING AND GLUING MACHINERY
Potdevin Machine Co.
Waldron Corporation, John
GUMMED SEALING TAPE
Paper Manufacturers Co.
GUMMED TAPE TESTERS
Thwing Instrument Co.
HAND CLEANER
Magnus Chemical Co.
HAND CLEANER DISPENSERS
Magnus Chemical Co.
HEATERS (Unit)
J. O. Ross Engrg. Corp.
HEATING AND VENTILATING SYSTEMS
Ross Engineering Corp., J. O.
HIGH DENSITY THICKENERS
Moore & White Co.
HOISTS (ELECTRIC)
General Electric Co.
HYDRAULIC MACHINERY
Farrel-Birmingham Co.
INDICATORS
Alpha Lux Co.
The Bristol Co.
Testing Machines, Inc.
INTERFOLDING MACHINES
Hudson Sharp Machine Co.
Paper Converting Machine Co., Inc.
John Waldron Corp.
INSTRUMENTS
Alpha Lux Co.
The Bristol Co.
Testing Machines, Inc.
JORDANS
The Appleton Machine Co.
Emerson Manufacturing Co.
Jones & Sons Co., E. D.
Smith & Winchester Mfg. Co.
Valley Iron Works
JORDAN FILLINGS
Bahr Bros. Mfg. Co., The
Bolton & Sons, Inc., John W.
Jones & Sons Co., E. D.
Smith & Winchester Mfg. Co.
Valley Iron Works
KNIVES, ETC.
E. C. Atkins & Co.
Bolton & Sons, Inc., John W.
Carthage Machine Co.
Dilts Machine Works, Inc.
Hamblet Machine Co.
Taylor, Stiles & Co.
LABELLING MACHINES
Potdevin Machine Co.
LABORATORY EQUIPMENT
Emerson Manufacturing Co.
E. D. Jones & Sons Co.
Pusey and Jones Corp.
Testing Machines, Inc.
Thwing Instrument Co.
Valley Iron Works.
LATEX
Heveatex Corporation
LATEX CEMENTS
Arabol Manufacturing Co.
LATHES
Montague Machine Co.
LAY BOYS
Hamblet Machine Co.
Moore & White Co.
LITHOPONE
United Color & Pigment Co.
LOFT DRYERS
Ross Engineering Corp., J. O.
John Waldron Corp.
LUBRICANTS
Gulf Refining Co.
Port Huron Xylite Co.
Socony-Vacuum Corporation
MACHINE PARTS (Forged)
Kropp Forge Co.
MAGNIFIERS (Pocket)
Bausch & Lomb Optical Co.
METERING & PROPORTIONING SYSTEMS
Trimbey Machine Works
MICRO-PROJECTORS
Bausch & Lomb Optical Co.
MICROSCOPES
Bausch & Lomb Optical Co.
Testing Machines, Inc.
MOTORS
Allis-Chalmers Mfg. Co.
General Electric Co.
MOULDS
Carthage Machine Co.
International Nickel Co.
Montague Machine Co.
NAPKIN FOLDING MACHINE
Hudson Sharp Machine Co.
Paper Converting Machine Co., Inc.
Waldron, John, Corp.
OPACIFYING PIGMENT
New Jersey Zinc Co.
Titanium Pigment Co.
United Color & Pigment Co.
R. T. Vanderbilt Co.
PACKING (Rubber)
B. F. Goodrich Rubber Co.
The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.
U. S. Rubber Co.
PADDING GLUES
Arabol Manufacturing Co.
PAPER BAG MACHINERY
Potdevin Machine Co.
Smith & Winchester Mfg. Co.
PAPER BREAK RECORDERS
Thwing Instrument Co.
Westinghouse Electric & Mfg. Co.
PAPER CUTTERS
E. C. Atkins & Co.
Dillon Machine Co.
Hamlet Machine Company
Moore & White Co.
Seybold Machine Co.
Smith & Winchester Mfg. Co.
PAPER MACHINE APRONS
Goodrich Rubber Co., B. F.
PAPER MANUFACTURERS
Hammermill Paper Co.
West Virginia Pulp & Paper Co.
PAPER MACHINE HOODS
Ross Engineering Corp., J. O.
PAPER MACHINE SLICES
Montague Machine Co.
PAPER AND BOARD CUTTERS
Beloit Iron Works
PAPER AND PULP MACHINERY
Beloit Iron Works
Downingtown Manufacturing Co.
Emerson Manufacturing Co.
Farrel-Birmingham Co.
E. D. Jones & Sons Co.
Lobdell Car Wheel Co.
Moore & White Co.
Perkins & Son, Inc., B. F.
Pusey & Jones Corp.
Smith & Winchester Mfg. Co.
Valley Iron Works Co.
PAPER ROLLS
B. F. Perkins & Son, Inc.
Textile Finishing Mchy Co.
Waldron Corp., John
PAPER SCALES
Testing Machines, Inc.
Thwing Instrument Co.
PAPER STOCK WASHERS
Jones & Sons Co., E. D.
PAPER TESTERS
Alpha Lux Co.
Perkins & Son, Inc., B. F.
Testing Machines, Inc.
Thwing Instrument Co.
Valley Iron Works Co.
PAPER TUBE MACHINERY
Dietz Machine Works
Langston Co., Samuel M.
PAPER WAXING MACHINERY
Waldron Corp., John

WHERE TO BUY

PASTES
Arabol Manufacturing Co.

PASTING MACHINES
Potdevin Machine Co.
John Waldron Corp.

PENESCOPE PENETRATION TESTER
Thwing Instrument Co.

PERFORATING MACHINES
Dietz Machine Works
Waldron, John, Corp.

PERFORATED METAL
Harrington & King Perforating Co.
Hendrick Mfg. Co.

PIPE (Stainless)
Illinois Steel Co.
International Nickel Co.
Mundt & Sons, Charles
National Tube Co.

PIPING
Crane Company

PLATING, CHROMIUM
Chromium Corp. of America

PLATERS
Perkins & Son, Inc., B. F.

PLAYING CARD MACHINERY
Waldron, John, Corp.

POWER TRANSMISSION EQUIPMENT
Chain Belt Co.
De Laval Steam Turbine Co.
Farrel-Birmingham Co.
Link-Belt Co.

PRECISION INSTRUMENTS
Alpha Lux Co.
The Bristol Co.
Taylor Instrument Co.
Testing Machines, Inc.
Thwing Instrument Co.

PRESSES (Napkin)
Paper Converting Machine Co.
Waldron Corp., John

PRESS ROLLS
American Wringer Co., Inc.
Beloit Iron Works
Downingtown Manufacturing Co.
Emerson Manufacturing Co.
Goodrich Rubber Co.
Montague Machine Co.
The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.
Pusey & Jones Corp.
Valley Iron Works Co.

PRESS ROLLS (Granite)
Beloit Iron Works
Perkins & Sons, Inc., B. F.
Pusey and Jones Corp.

PRESSURE BULKER
B. F. Perkins & Son, Inc.

PRINTING MACHINES
Potdevin Machine Co.
Waldron, John, Corp.

PRINTING PRESSES
Hudson Sharp Machine Co.
Potdevin Machine Co.
Paper Converting Machine Co., Inc.
John Waldron Corp.

PULLEYS
Chain Belt Co.
Link-Belt Co.
Montague Machine Co.

PULPERS
E. D. Jones & Sons Co.

PULP MILL EQUIPMENT (Chemical)
Carthage Machine Co.
Chemipulp Process, Inc.
Jenssen, J. D., Company

PULPSTONES
Carborundum Co.
Norton Co.

PULP PRESSES
Farrel-Birmingham Co.

PULP SCREENS
E. D. Jones & Sons Co.
Trimbey Machine Works

PULPS (SULPHITE)
Andersen Co., J.
Lagerloef Trading Co.
Perkins-Goodwin Co.
Price & Pierce, Ltd.
Pulp and Paper Trading Co.

PULP THICKENERS
Moore & White Co.

PUMP PRIMERS (Steam and Water Jet)
Valley Iron Works Co.

PULP WOOD MACHINERY
Montague Machine Co.

PUMPS (Acid)
Carthage Machine Co.
De Laval Steam Turbine Co.
Frederick Iron and Steel Co.
Moore & White Co.
Morris Machine Works
Oliver United Filters Inc.
Pusey and Jones Corp.
Valley Iron Works

PUMPS (Centrifugal)
Allis-Chalmers Co.
Pusey and Jones Corp.

PUMPS (Reciprocating)
Morris Machine Works

PUMPS (Rotary Cycloidal)
Morris Machine Works

PUMPS (Stuff)
Allis-Chalmers Co.
Beloit Iron Works
De Laval Steam Turbine Co.
Dillon Machine Co.
Downingtown Mfg. Co.
Frederick Iron and Steel Co.
International Nickel Co.
Moore & White Co.
Morris Machine Works
Oliver United Filters Inc.
Pusey and Jones Corp.
Smith & Winchester Mfg. Co.
Valley Iron Works Co.

PUMPS (Suction)
Moore & White Co.
Morris Machine Works

PUMPS (Vacuum)
Morris Machine Works

PYROMETERS (Roll)
The Bristol Co.
Thwing Instrument Co.

RAG CUTTERS
Perkins & Son, Inc., B. F.
Taylor Stiles & Co.

REAM COUNTERS
Hamblet Machine Co.

RECORDING INSTRUMENTS
The Bristol Co.
Taylor Instrument Co.
Testing Machines, Inc.
Thwing Instrument Co.

RECORDING TACHOMETERS
Alpha Lux Co.
The Bristol Co.
General Electric Co.
Pusey & Jones Corp.

RECOVERY SYSTEMS (Soda & Sulphite)
Ross Engineering Corp., J. O.

RECOVERY SYSTEMS (Waste Heat)
Ross Engrg. Corp., J. O.

REELS, (Upright & Revolving)
Beloit Iron Works
De Laval Steam Turbine Co.
Emerson Manufacturing Co.
Moore & White Co.
Pusey & Jones Corp.

REFINERS (Centrifugal)
Bahr Bros.

REFINING ENGINES
Emerson Manufacturing Co.
Jones & Son Co., E. D.

REFRACTORIES
Carborundum Co.
Norton Co.

REGULATORS
The Bristol Co.
Merritt Engrg. & Sales Co., Inc.
Trimbey Machine Works

REPAIRS
Dayton Globe Iron Works

REWINDERS
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Cameron Machine Co.
Dietz Machine Works
Hamblet Machine Co.
Langston Co., Samuel M.
Moore & White Co.
Smith & Winchester Mfg. Co.
John Waldron Corp.

ROD MILL
Allis-Chalmers Co.
Mine & Smelter Supply Co.

ROLLS
American Wringer Co.
Goodrich Rubber Co.
Montague Machine Co.
Textile Finishing Machy. Co.
The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.
John Waldron Corp.

ROLLS (Chilled Iron & Gray Iron)
Farrel-Birmingham Co.
Lobdell Car Wheel Co.
Smith & Winchester Mfg. Co.
Valley Iron Works

ROLLS (Forged)
Kropp Forge Co.

ROLLS (Rubber or Rubber Covered)
American Wringer Co.
B. F. Goodrich Rubber Co.
Montague Machine Co.
The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.
United States Rubber Co.

ROLL GRINDERS
Farrel-Birmingham Co.
Lobdell Car Wheel Co.

ROLL SLITTING MACHINES
Cameron Machine Co.
Langston Co., Samuel M.

ROLL STANDS
Cameron Machine Co.
Moore & White Co.

ROLL WINDING MACHINES
Cameron Machine Co.

ROOF PLANKS (Awico-Ized)
Processed Lumber Co.

ROSIN SIZE
American Cyanamid & Chemical Corp.
Bennett, Inc.
Paper Makers Chemical Co.

ROTARY SCREENS
E. D. Jones & Sons Co.
Moore & White Co.
Valley Iron Works

RUBBER GOODS
American Wringer Co.
Goodyear Tire & Rubber Co.
B. F. Goodrich Rubber Co.
The Manhattan Rubber Mfg. Co.
United States Rubber Co.

RUBBER HOSE
B. F. Goodrich Rubber Co.
Goodyear Tire & Rubber Co.
The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.
United States Rubber Co.

SALT
Pennsylvania Salt Co.

SAND & POLISHING MACHINES
Carborundum Co.
Waldron, John, Corp.

SATURATING MACHINES
Moore & White Co.
Potdevin Machine Co.
Waldron, John, Corp.

SAVEALLS
Carthage Machine Co.
De Laval Steam Turbine Co.
Moore & White Co.
Oliver United Filters Inc.

SAWS
E. C. Atkins & Co.

SCORE TESTERS
Thwing Instrument Co.

SCREEN DIAPHRAGMS
Goodrich Rubber Co., B. F.

SCREENS
Appleton Wire Works
Beloit Iron Works
Carthage Machine Co.
Chain Belt Co.
International Wire Works
E. D. Jones & Sons Co.
Link-Belt Co.
Montague Machine Co.
Moore & White Co.
Valley Iron Works

SCREEN PLATE
Hendrick Mfg. Co.
Union Screen Plate Co.

SEALING TAPE (Gummed)
Paper Manufacturers, Inc.

SHAFTS (Forged)
Kropp Forge Co.

SHEAVES
Montague Machine Co.

SHOWER PIPES
Emerson Manufacturing Co.
E. D. Jones & Sons Co.
Montague Machine Co.
Moore & White Co.
Smith & Winchester Mfg. Co.

SHREDDERS (Pulp and Paper)
Carthage Machine Co.
E. D. Jones & Sons Co.
Taylor Stiles & Co.

SILICATE OF SODA
American Cyanamid & Chemical Corp.

SIZING
National Oil Products

SIZING PROCESS
Bennett, Inc.
National Oil Products Co.
Ross Engrg. Corp., J. O.

SLIME REMOVER
Magnus Chemical Co.

SLITTERS AND REWINDERS
Beloit Iron Works
Cameron Machine Co.
Dietz Machine Works
Hamblet Machine CO.
Langston Co., Samuel M.
Moore & White Co.
Pusey & Jones Corp.
Smith & Winchester Mfg. Co.
Waldron Corporation, John.

SODA ASH
American Cyanamid & Chemical Corp.
Diamond Alkali Company
Mathieson Alkali Works, Inc.
Paper Makers Chemical Corp.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.

SOAP POWDER
Magnus Chemical Co.
Paper Makers Chemical Corp.

SOLVENT SIZING
Beloit Iron Works

SORTING TABLES
Moore & White Co.

SPECIAL MACHINERY
Carthage Machine Co.
Farrel-Birmingham Co.
Hamblet Machine Co.
Hudson Sharp Machine Co.
Montague Machine Co.
Paper Converting Machine Co., Inc.
John Waldron Corp.

SPEED CHANGES (Variable)
Moore & White Co.

SPEED REDUCERS
Beloit Iron Works
De Laval Steam Turbine Co.
Farrel-Birmingham Co.
Link-Belt Co.
Pusey and Jones Corp.

SPIRAL BEVEL GEARS DRIVE STANDS
Beloit Iron Works
Moore & White Co.
Pusey and Jones Corp.

SPROCKETS
Chain Belt Co.

STAIR and FLOOR TILES—(Non-Slip)
Carborundum Co.
Norton Company

STAIR TREADS
Carborundum Co.
Norton Company

STARCH
American Cyanamid & Chemical Corp.
Clinton Co.
Corn Products Refining Co.

STEAM SPECIALTIES
Crane Company

STEEL BELT LACING
Flexible Steel Lacing Co.

STOCK CUTTERS
Perkins & Sons, Inc., B. F.

STEEL (Electric Furnace)
Timken Roller Bearing Co.

STEEL (Open Hearth)
Timken Roller Bearing Co.

STEEL (Stainless)
American Sheet & Tin Plate Co.
Illinois Steel Co.
Jones & Sons Co., E. D.

STEEL PLATE CONSTRUCTION
Hendrick Mfg. Co.
Link Belt Co.
Ross Engrg. Corp., J. O.

STOCK REGULATORS
Merritt Engineering & Sales Corp., The
Trimbey Machine Co.

STOKERS
Frederick Iron and Steel Co.

STRAW MAKING MACHINERY
Samuel H. Langston Co.

STUFF CHESTS
Hauser Stander Tank Co.
Jones & Sons Co., E. D.
Kalamazoo Tank & Silo Co.
Moore & White Co.
Valley Iron Works Co.

STUFF PUMPS
Beloit Iron Works
De Laval Steam Turbine Co.
Dillon Machine Co.
Downingtown Mfg. Co.
Frederick Iron and Steel Co.
Moore & White Co.
Morris Machine Works
Pusey and Jones Corp.
Smith & Winchester Mfg. Co.
Valley Iron Works Co.

SUCTION BOX COVERS
Emerson Manufacturing Co.
Moore & White Co.
Pusey and Jones Corp.

SUCTION ROLLS
American Wringer Co.
Beloit Iron Works
Downingtown Manufacturing Co.

SULPHITE (Bleached and Unbleached)
Anderson & Co., J.
Lagerioef Trading Co.
Perkins-Goodwin Co.
Price & Pierce Ltd.

SULPHUR
American Cyanamid & Chemical Corp.
Ashcraft Wilkinson Co.
Texas Gulf Sulphur Co.

SUPER CALENDERS
Beloit Iron Works
Farrell-Birmingham Co.
Lobdell Car Wheel Co.
Moore & White Co.
Norwood Engrg. Co.
Perkins & Son, Inc., B. F.
Smith & Winchester Mfg. Co.
Textile Finishing Mchy. Co.

TABLE ROLLS
American Wringer Co.
Beloit Iron Works
Goodrich Rubber Co., B. F.
Pusey and Jones Corp.

TACHOMETERS
The Bristol Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

TANKS
Hauser Stander Tank Co.
Hendrick Mfg. Co.
International Nickel Co.
Kalamazoo Tank & Silo Co.
The Manhattan Rubber Mfg. Co.
Pusey & Jones Corp.
J. O. Ross Engrg. Corp.

TEAR TESTERS
Testing Machines, Inc.
Thwing Instrument Co.

TEMPERATURE RECORDERS
The Bristol Co.
General Electric Co.
Taylor Instrument Co.
Testing Machines, Inc.
Thwing Instrument Co.
Westinghouse Electric & Mfg. Co.

TENSILE TESTERS
Perkins & Sons, Inc., B. F.
Testing Machines, Inc.
Thwing Instrument Co .

TESTERS (Bursting Strength)
Testing Machines, Inc.
Perkins & Son, Inc., B. F.

TESTING LABORATORY
E. I. DuPont De Nemours & Co., Inc.

TEXROPE DRIVES
Allis-Chalmers Mfg. Co.

THERMOMETERS
The Bristol Co.
Taylor Instrument Co.
Testing Machines, Inc.
International Nickel Co.
Pusey & Jones Corp.

TITANIUM PIMENT
Titan'um Pigment Co.
R. T. Vanderbilt Co.

TIE RODS
International Nickel Co.

TOILET FOLDING MACHINES
Hudson Sharp Machine Co.
Paper Converting Machine Co., Inc.

TOILET ROLL LABELLING MACHINES
Curt G. Joa, Inc.

TOILET WINDERS
Cameron Machine Co.
Dietz Machine Works

TOWEL FOLDING MACHINES
Paper Converting Machine Co., Inc.
Waldron Corp., John

TOWEL INTERFOLDING MACHINES
Dietz Machine Works

TOWEL WINDER
Cameron Machine Co.
Hudson Sharp Machine Co.
Waldron Corp., John

TRANSMISSION MACHINERY
Beloit Iron Works
Chain Belt Co.
De Laval Steam Turbine Co.
Farrel-Birmingham Co.
Link Belt Co.
Timken Roller-Bearing Co.

TREADS (Non-Slip)
Carborundum Co.
Norton Company

TRAPS (Steam)
Crane Company

TRUCKS
Moore & White Co.

TUBES (Paper)
Climax Tube Co.
Elixman Paper Core Co.

TUBING (Seamless Steel)
National Tube Co.
Timken Roller Bearing Co.

TUBS (Beater)
Hauser Stander Tank Co.

TUBS (Wood)
De Laval Steam Turbine Co.
Hauser Stander Tank Co.

TURBINES (Hydraulic)
Allis-Chalmers Mfg. Co.
De Laval Steam Turbine Co.
Sturtevant Co., B. F.

TURBINES (Water)
De Laval Steam Turbine Co.
Sturtevant Co., B. F.

TURBO-GENERATORS
Allis-Chalmers Mfg. Co.
De Laval Steam Turbine Co.

V-BELTS
Allis-Chalmers Mfg. Co.
B. F. Goodrich Rubber Co.
Goodyear Tire & Rubber Co.
United States Rubber Co.

VACUUM CONTROL
Appleton Machine Co.
Broughton Systems

VALVES
Carthage Machine Co.
Crane Company
International Nickel Co.
E. D. Jones & Sons Co.
Ross Engineering Corp.
Trimby Machine Works
Walworth Co.

VENTILATING SYSTEMS
Propellair, Inc.
J. O. Ross Engrg. Corp.

WASHERS
Carthage Machine Co.
Emerson Manufacturing Co.
E. D. Jones & Sons Co.
Moore & White Co.
Oliver United Filters Inc.

WAXING MACHINERY
Potdevin Machine Co.
Waldron, John, Corp.

WAX SIZE
American Cyanamid & Chemical Corp.
Bennett, Inc.
National Oil Products Co.
Paper Makers Chemical Corp.

WET MACHINES
Carthage Machine Co.
Emerson Manufacturing Co.
Montague Machine Co.
Pusey Jones Corp.
Smith & Winchester Mfg. Co.
Valley Iron Works

WINDERS
Beloit Iron Works
Cameron Machine Co.
Langston Co., Samuel M.
Moore & White Co.
Pusey & Jones Corp.
Shartle Bros. Machine Co.
Smith & Winchester Mfg. Co.
John Waldron Corp.

WIRES
Appleton Wire Works
International Wire Works

WIRE CLEANERS
Magnus Chemical Co.

WIRE CLOTH
International Nickel Co.

WIRE GUIDES
Moore & White Co.
John Waldron Corp.

WIRE GUIDE ROLLS
American Wringer Co.
Goodrich Rubber Co., B. F.

WIRE STRETCH ROLLS
American Wringer Co.
Valley Iron Works Co.

WOOD SPLITTERS
Carthage Machine Co.
Moore & White Co.

WORMED CUTTERS
American Wringer Co.

WRENCHES
Walworth Co.

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ZINC SULPHIDE PRODUCT
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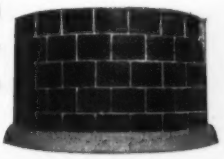

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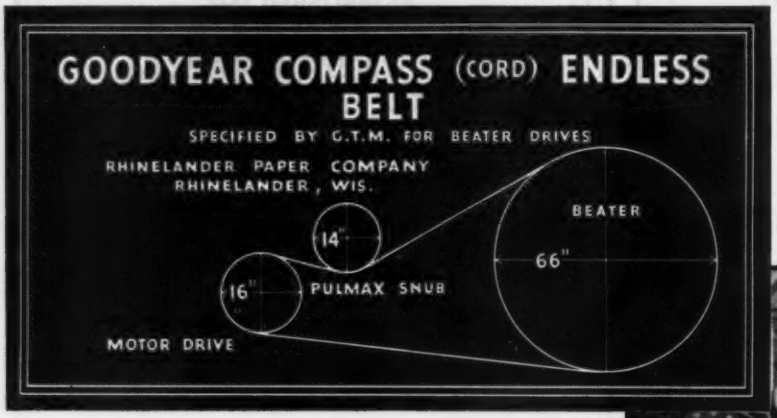

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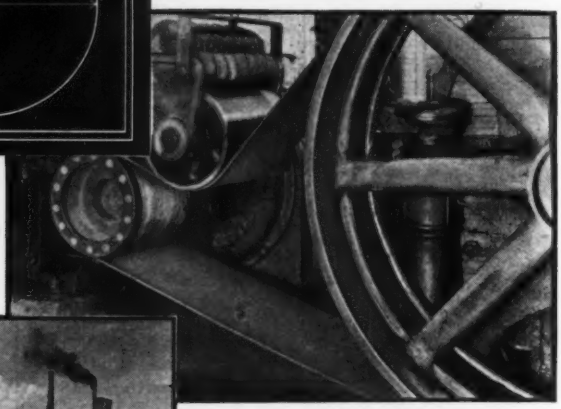

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